



JOHN AITKEN, M. D.



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ESSAYS
ON
FRACTURES
AND
LUXATIONS.

BY
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P R E F A C E.

THE Essay on Fractures was published many years ago; and although so well received, that the Edition was soon sold off, yet being much engaged, I did not find leisure to republish it sooner, with the improvements that farther experience had suggested.

As the doctrines of Fracture and Luxation have a strong affinity to one another, it was supposed, that it might not be improper to conjoin them: An Essay on Luxation, therefore, follows that on Fracture.

I have

P R E F A C E.

I have studied perspicuity in style, and simplicity in doctrine; recollecting, that the end of the eighteenth century is high time to exhibit the useful sciences entirely undisguised.

Future writers on the subjects of these Essays may perhaps make useful additions, according as experience and scientific progress shall enable them; but I am humbly of opinion, that it will not be soon in their power to devise modes of cure more simple and efficient than those described in the following pages.

J. A.

DEDI.

T O
LORD GARDENSTON,

One of the

SUPREME JUDGES OF SCOTLAND, &c.

MY LORD,

ALTHOUGH I have scarcely the honour to be known to you, I have nevertheless presumed to inscribe the following Essays to your Lordship; because, when I looked around among my countrymen for an illustrious name to grace this little Work, I found none more justly eminent and celebrated than yours. For who is

to be informed of the fair and high reputation of the most respectable and worthy LORD GARDENSTON? An enlightened, impartial, and manly Judge; a patriotic Citizen; the munificent Patron of Merit; and the steady Friend of Liberty and of Man.

WHOSE OPEN STORES,
THO' VAST, ARE LITTLE TO HIS AMPLER HEART;
THE FATHER OF A COUNTRY!

That your Lordship may long live an ornament to human nature, exhibiting to Society a venerable system of sublime, grand, liberal, and virtuous manners, is the sincere wish of,

MY LORD,

Your disinterested Admirer,

and devoted humble Servant,

JOHN AITKEN.

EDINBURGH; }
Dec. 1789. }

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OF FRACTURES.

INTRODUCTION.

THE bones, when perfect or mature, are whitish, rigid, brittle, in a great measure insensible, and of various forms. Their external part, the most dense and solid, is composed of plates, or laminae; therefore named laminated. Their internal substance is more loose and cellular; and, on account of its resemblance to lettice-work, or cancelli, may be denominated cancellated. In the long and round bones of the extremities, this matter is so disposed, that there is a space in the middle of each less stored with it than elsewhere; on which account they have been called *Fistulous bones*.

The external surface of the bones is almost universally covered by a dense membrane, the *Periosteum*, seemingly continued from one to another

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over the whole ; to which it is most firmly connected by numerous vessels and fibres.

The internal or cancellated substance supports a cellular membrane, sui generis, commonly called Internal Periosteum ; but which with more justice may be named Medullary Membrane, as its cells contain, and probably prepare, the oil, marrow, or medulla of the bones.

Along this membrane, numerous blood-vessels are dispersed ; which, communicating with the vascular system by trunks more or less considerable, transmitted in channels evident in the laminated substance, support a circulation of the blood within the bones.

Although nerves have not been pointed out in the bones with sufficient precision, yet there is reason to conclude, that they are not destitute of them. Granulations arising from bones seem to have acute feeling ; and it may be admitted as a principle in Physiology, That where-ever function exists, there its organ must also exist.

The bones in proper union form a system named Skeleton, which greatly resembles the figure of the individual to which it belongs ; so that it may be

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be affirmed, that they are essential to our stability in the various attitudes; while at same time they contribute greatly to preserve the just disposition and arrangement of the numerous parts and organs that complete the animal: hence proportional disorder is constantly present where their structure is impaired, as in all the degrees of molities ossium.

With respect to the muscles, which in fact are a most astonishing system of springs, or elastic machines, the bones may be considered as so many levers of indispensable use, especially in locomotion, in the more perfect animal.

As services so important and essential are thus performed by the bones, it is evident, that their fractures must be instantaneously productive of the greatest disqualifications. It therefore ever has been, and must be, no inferior department in Surgery, to conduct their cure with propriety, so as to restore and preserve, as may be possible, the functions and form of the parts concerned. To unfold the principles of this great business, is the subject at present in view.

Although the idea conveyed by the term Fracture, employed to express a common disease of the

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bones, may seem very familiar even to the Tyro in Surgery ; yet, for his amusement, if not information, I judge it to be no way improper to offer a definition of this term, and also to subjoin a few physiological and pathological remarks, which appear to have a considerable connection with our subject, and which may throw light on the cure of Fracture, which is, as it ought to be, our chief object in this Essay ; in which I wish it to be remembered, that I principally keep in view Fractures of the long bones of the extremities : at same time it is plain, that general principles, to a certain degree, apply universally.

DEFINITION OF FRACTURE.

“ A division of a bone, by violence, into two or more fragments, with injury of the adjacent parts,” is a definition of Fracture perhaps sufficiently accurate and comprehensive. It excludes divisions by caries or the like.

If a power act on any piece of matter, so as to distract its component particles beyond a certain degree, a division into two or more portions is the unavoidable

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unavoidable consequence. When the animal substance is thus affected, according to its texture, the change produced is named Wound, Laceration, Rupture, or Fracture. The last term is chiefly confined to the bones, as above stated.

OF THE DISTINCTIONS OF FRACTURE.

Six distinctions or varieties of Fracture may be usefully adverted to.

1. Simple, when the adjacent soft parts are not much wounded, at least the wound is not visible.
2. Transverse, when the line of solution is at right angles with the axis of the affected bone.
3. Oblique, when this line makes acute angles with the axis of the bone.
4. Complicated, when a bone is broken in more places than one at the same time.
5. Comminuted, when the fragments are numerous.
6. Compound, when the parts adjacent to the

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the Fracture are wounded, especially if this has been done by a fragment protruded, and thereby become visible.

It is evident, that the transverse simple fracture, strictly considered, admits of no variety, while the oblique one may be simple or compound, and of many degrees; and if we restrict the compound fracture to denote an accompanying wound, inflicted by a fragment visibly protruded, there must be as many degrees of simple fracture as there are of violation sustained by the adjacent soft parts. These circumstances are well worth the attention of the Surgeon when employed in collecting a diagnosis, or forming a prognosis of any case of fracture.

OF THE COHESION OF THE OSSEOUS SUBSTANCE.

THE cohesion of the ultimate parts of any aggregate or mass of matter must be the effect of attraction, which may be considered as their connecting medium in all bodies, whether organised or not, and consequently in bones.

Although

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Although the cohesion subsisting among the particles of the bones of old animals may be greater than that of those of younger ones; yet it would appear, that, *ceteris paribus*, the former are more fragile than the latter.

This difference, supposing it to exist, is to be referred to a pliancy of the younger bones, derived from their abounding less with solid parts than aged bones, which the ossific process is constantly accumulating.

In consequence of this pliancy, young bones elude the effect of strokes, and the like, which may be styled a *vis percutiens*, although acting in a degree that might fracture old bones, in which the cohesion may be presumed to be greater; while the latter would probably resist a *vis distrahens* in a greater degree than the former could do.

This pliancy inherent in young bones unquestionably is derived from superior vascularity and succulency; for the bones of the foetus resemble somewhat a jelly, or gluten, intermixed with vessels, by whose action, undoubtedly, it and the other component parts are prepared, and effused; among which the osseous matter that produces the

rigidity of bones, is gradually and organically deposited. In the broad bones it appears in points called Centres, or Nuclei: in the middle of a long bone, in the form of a ring, and at same time an ossification takes place at each end, forming the epiphyses, while the middle one produces the body of the bone. These by degrees meet and unite.

OF THE RIGIDITY OF BONES.

It follows from what is premised, that as the pliancy of growing bones depends on comparative vascularity and succulency, the rigidity so characteristic of mature and old bones, results from the accumulation of osseous matter deposited perhaps interstitially, by the ossific action of their vessels; to this the rigidity proportionally succeeds.

It is not improbable, that Nature, ever attentive to the preservation of the individual, compensates the loss of pliancy possessed by young bones, by the greater cohesion enjoyed by mature and old ones.

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The greatest resistance which the bones can oppose to violences tending to fracture them, seems not to result either from their pliancy or rigidity singly considered, but from a combination of both; and this may justly be presumed to be most complete at that period when the system is fully evolved, viz. at puberty.

It may be added, that it is pretty certain, that from the first moment of existence to the last one, the animal body is continually suffering a loss of vascularity and succulency; and this change takes place, not in the bones only, but in the other parts proportionally, in all probability by the accumulation of earthy matter; so that, in consequence of the inseparable connection between organ and function, already mentioned, our powers are gradually lost, and animation spontaneously terminates. This is what is properly called natural death.

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OF THE MARROW OR OIL OF THE BONES.

To ward off as long as long as possible the effects of diminished vascularity and succulency, Nature has provided a store of oil or marrow in the cancellated parts of all bones, and seemingly in proportion to their various exigencies. The encrease of this keeps pace with their diminution.

It has been already suggested, that the oil of bones is fabricated by their vessels; and this must be the fact; for there is no other agent; and perhaps this oil is capable of pervading the laminated substance; at least this certainly happens after death.

The equitable diffusion of this oil, which we may suppose to take place, tends to retard the fragility, and the other changes induced by age. In advanced life, therefore, the resistance of bones to fracturing powers may be referred, in no small degree, to their marrow, which begins to abound
when,

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when, on this supposition, its presence is necessary.

It is alleged, that when extreme old age advances, even this oil becomes deficient; an event to be ascribed to the change of the medullary vessels; for specific structure being lost, specific action must be likewise lost. This circumstance, perhaps, explains the cause why in very old subjects, the bones are comparatively brittle, and when fractured, admit of healing with difficulty.

It may be further remarked, that if the resistance of bones to fracturing causes depends in any degree on their oil, that which affects their oil in quantity or quality will diminish their resistance: A circumstance not to be overlooked in the consideration of the predisposing causes of fracture.

OF THE CAUSES OF FRACTURE.

CAUSATION is one of the most interesting topics in philosophy, and especially in Medicine: for till the causes of diseases are investigated, as far as their nature admits of, we cannot hope to be able to apply proper remedies.

Whatever has the effect to encrease the fragility of the bones must be a predisponent cause of fracture. It has been already remarked, that this takes place in consequence of a loss of vascularity and succulency; and it may be added, of diseases which affect the fluids, especially the gluten and marrow.

1. Old age and long-continued and hard labour are supposed to predispose to fracture, in the way stated above.

2. If the pliancy or tenacity of bones depends in any degree on their gluten and marrow, it may be concluded, that diseases which vitiate these component

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component parts must proportionally induce fragility; of which the following may be named: The syphilitic, or venereal; the scorbutic, or putrescent; the arthritic, or gouty; the strumous, or scrophulous; the rachitic, or rickety; and the carcinomatous, or cancerous.

It would doubtless be foreign to the plan of this Treatise, to attempt a particular inquiry into the natures of these diseases; it may be sufficient in general to state, that it is highly probable, that acrimony, of various quality and degree, is generated by the vitiation of the vessels; and this produces the fragility in question; for in some cases the texture of the bones has thus been so perverted, that fracture has occurred from the smallest attempt to rise, stand, or walk.

An intensely cold or frosty atmosphere has been imagined capable to render the bones more than ordinarily brittle. The frequency of fractures during frosty weather seems to have given rise to this opinion; but it should be remembered, that the great hardness and slipperiness of the ground in frost are sufficient to account for this fact, without an encreased fragility; and that, while the body in general is healthy, and the circulation of
the

the blood duly performed, the temperature of the bones cannot be altered ; or, in other words, they cannot be frozen.

External violence is the occasional cause of those fractures intended to fall under our definition, and to which of course our remarks principally apply ; for those that are chiefly induced by the predisposing causes enumerated, are in fact not idiopathic, but symptomatic affections, and require, previous to their cure, that the primary diseases be removed : Therefore it is, that the treatment of the former most properly falls within the Surgeon's province. The truth is, that external violence, supposed to be the occasional cause of idiopathic fracture, is often so great as to require no assistance from predisposition. A like remark may be made with respect to the occasional causes of many other diseases.

It appears to be an incontrovertible proposition in pathology, That the proximate cause of a disease is the change or derangement induced by the remote causes, which comprehend the predisponent and occasional ones : therefore the proximate cause of fracture is a linear solution of the osseous substance.

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OF FRACTURES.

In many of the chirurgical diseases, the proximate cause, like that of fracture, is palpable and evident; but it does not follow, that in the general or internal diseases, it is not also a specific derangement, or peculiar morbid condition, producing the symptoms; although, from the minuteness of the organization of the seats of such diseases, this cannot be defined with equal precision.

OF THE SYMPTOMS OF FRACTURE.

If the violence, or occasional cause of the fracture, has wounded the integuments or muscular parts, or if a fragment is pushed through, so as to be seen or felt, it is a case of compound fracture, as defined above, and is self-evident.

Although the compound fracture cannot be mistaken by the least versant in our subject, yet the case is far otherwise with regard to simple fracture; for in numberless instances it has been overlooked, and the mistake discovered too late to admit of remedy. Some circumstances indeed, such

as the natural thickness of the parts surrounding the fracture, corpulency, swelling, and tension, often occasion abundant perplexity in ascertaining the diagnosis even to the best informed and most experienced Surgeon. It therefore becomes necessary to enumerate the principal diagnostics: it is supposed that an adequate occasional cause has operated.

1. Very acute and pungent pain, especially where the suspected part is moved or compressed by the hand or otherwise. This arises from the direct and strong stimulus of the fragments acting on the muscles and nerves, also from the derangement of the medullary membrane, periosteum, muscles, and nerves, situated near the fracture.

2. A mutual friction or grating of the fragments, often very perceptible to the touch, and sometimes audible. This symptom alone is decisive evidence, or absolutely pathognomonic.

3. Deformity of the suspected part or limb, more or less considerable, such as curvature, shortening, &c. This circumstance is especially recognised when the fracture happens to be oblique,

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lique, and the inferior fragments displaced. In the purely transverse one, sometimes this symptom is not present.

4. Loss of motion, or comparative inability to use the limb, especially below the supposed seat of the fracture. This arises from the derangement and lesion of adjacent and perhaps adhering muscles, particularly those attached to the inferior fragments.

5. Swelling and tension of the parts surrounding the suspected bone in various degrees. It appears from innumerable facts, that there is an indissoluble relation between acute pain and swelling; this last being nothing other than a determination or afflux of blood to the pained or irritated part. It seems to be what Wiseman and his contemporaries called a Fluxion; which may perhaps be explained in this way.

The motion of the blood is entirely occasioned by the action of its vessels, which is as the irritation to which they are subjected. When this action is morbidly increased, the blood is proportionally propelled, the exhalants opening into the cellular substance effuse more

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than usual, while the absorbents take up less. This accumulation soon affects the vessels, disturbing, as would seem, but not diminishing their action, while the transmission is impeded. Thus necessarily the tumefaction in question is produced.

This state of a pained part, when the stimulus is strong, is frequently changed into inflammation, which, as will appear hereafter, is an unfortunate circumstance.

At other times this swelling partakes of the nature of ecchymosis, being suddenly produced by ruptured vessels pouring their blood into the cellular substance, according to the degree of injury sustained by the soft parts, whether from the action of the occasional cause, or the dislocation of a pointed fragment. This also readily passes into the inflamed state.

The only diseases with which simple fracture is likely to be confounded, are luxation and contusion.

Luxation is necessarily seated in a joint. By this circumstance a discrimination may be made.

Indeed

Indeed sometimes fracture and luxation are combined. Contusion does not produce curvature or shortening of the limb: there can be no friction as above described; and the pain is not so much aggravated as in fracture.

Anatomy is here of indispensable utility, as well to the patient as Surgeon; ensuring, in a great measure to the former a successful management, and to the latter honour and satisfaction.

OF THE PROGNOSIS.

THE simple transverse fracture is ofteneft speedily and happily cured. On the other hand, the cure of the oblique one much seldomer terminates agreeably to the wishes of the patient and Surgeon: so that deformity, or loss of function in various degree is too frequently the consequence.

This result would seem to be, *cæteris paribus*, as the obliquity; for when this is considerable,

the fragments are with difficulty preserved in proper apposition; and their extremities being pointed, prove more stimulant, and destructive to the fleshy parts.

The proximity of a joint, on account of the peculiar nature of its constituent parts, cannot fail to encrease the danger that otherwise would attend any fracture; for inflammation and effusion here must be peculiarly pernicious.

It may be needless to observe, that as the danger is almost as the number of fragments, the complicated and comminuted must be liable to greater accidents, viz. swelling, inflammation, &c. than the strictly simple fracture.

Fractures are more or less dangerous and molesting, according to the degree of violation which the surrounding parts have sustained: therefore compound are universally more dangerous than simple fractures.

OF THE NATURE AND FORMATION OF CALLUS.

The Author of nature has wisely and wonderfully implanted powers in the animal and vegetable systems capable of repairing loss of substance and other injuries which they may suffer, to a certain extent, and under certain circumstances. Of these, surprising exertions are every day to be observed; but no instances of this kind are more remarkable than the exfoliation, and consequent regeneration of large portions of the bones, and the firm re-union of their several pieces after fracture.

The substance, by whose intervention the concretion of the fragments of the bones is partly effected, is named Callus.

Authors are much divided about the source whence the callus flows: while M. de Hamel contends,

contends, that it is furnished solely from the periosteum, the learned and indefatigable Haller, and Camper, with greater probability, assert, that it is only effused from the substance of the fractured bones. Indeed the latter talks of a double callus; one part external, formed between the periosteum and the laminated surface; and another internal, or the separation and elongation of the laminae.

The young callus, however, never assumes the osseous nature, till it has been pervaded by the ossific vessels, shooting from the neighbouring parts, which unquestionably had effused it, like as the inflammatory action of the vessels of the softer parts, forms and pours out pus. By this means it acquires an organization analogous, tho' inferior in degree to that which the bones naturally enjoy.

The morbid states of the system already enumerated, as predisponent to fracture, also greatly influence the formation of callus. Sometimes they not only retard, but altogether prevent it. The scorbutic diathesis is particularly fatal to the growth of callus; it has been observed to destroy
it

it in its most confirmed state; fractures, after having been re-united for many years, have appeared in consequence of this affection as if recent.

It is alledged, that the state of pregnancy is unfavourable to the production and perfecting of callus; and, for this reason, fractures happening during that condition are said to admit only of very slow cure.

The time requisite to confirm or perfect the callus, after fractures, must be different in the different bones; and in patients of different ages and constitutions: At a medium, it has been supposed, that the fractured radius may unite within four weeks; the ulna and humerus within six; and the os femoris seldom under seven, or perhaps ten weeks.

As the formation of callus is altogether Nature's work, and cannot be influenced by artificial means, the absurdity of all topical and quackish applications, as well as internal remedies,

dies, with a view to hasten it, or, when formed, to dissolve or soften it, is too self-evident to require illustration.

OF THE METHOD OF CURE, OR TREATMENT OF FRACTURES.

AFTER being fully convinced, from the concomitant symptoms, that a bone is fractured, the Surgeon's business is, to reduce its fragments to their natural situation; and there to retain them, by proper means, till the healing power, by the interposition of callus, completes the cure. Indeed, under the best management, this is sometimes prevented by the interposition of membrane or muscle.

This part of our subject naturally divides itself into three branches; Extension, Coaptation, and Retention. And these, well effected, constitute what

what may be called the Artificial or Chirurgic cure, which is subservient, although not essential, to what may, in opposition, be termed the Natural cure.

[EXTENSION.

THE contradicthility, or vis infita, of the muscular fibres, during life, is constantly exerted, or the muscles have a constant tendency to shorten themselves, as far as their structure permits: this is only prevented, beyond a certain degree, by the resistance which the bones oppose to it. When, the bones are fractured obliquely, or indeed transversely, provided the fracturing cause has sufficiently disengaged the fragments from one another, this resistance will be in, a great measure, removed; at the same time that the muscular power, from the strong and rude stimulus of the fragments, is much encreased: by this means the lower fragments are very often forced to over-top the upper ones. To reduce these, extension becomes absolutely necessary, and ought

to be proportioned to the resistance, which is as the connecting and acting muscles.

In some favourable transverse fractures, no displacement of the fragments ensues. This circumstance plainly supercedes the necessity of extension.

As the design of extension is to reduce the lower fragments, which, for reasons adduced, can only be displaced, it is easy to perceive, that there can be no necessity for what is called Counter-extension. If any idea is conveyed by this term, it seems only to be the retracting of the upper fragments,

In performing extension, the upper fragments must be fixed, or held steadily in one posture. The traction, or extending power, whether the hands or mechanical assistance, is to be applied to the lower fragments only; for no good reason can be assigned, why, by applying it to a more distant part of the limb, the intervening articulations should be racked and strained, and perhaps luxation added to fracture.

For another and perhaps more important reason,

son, the application of the extending power to a distant part of the limb, is highly improper and unscientific, viz. the muscles, by this procedure, are all put on the stretch, and their tension infallibly increased; and consequently the resistance to the traction much augmented, which by every possible means should carefully be diminished.

A considerable relaxation of the muscles of the leg and arm is obtained, by keeping the knee and elbow joints in a state of semiflexion while extension is performing. This circumstance deserves to be particularly attended to. If a joint intervenes betwixt the fracture and the part to which the extending power is applied, a few supposable cases excepted, this relaxation is not to be obtained.

Although this practice of relaxing the muscles to facilitate the extension, as well as retention of fractured bones, stands supported by anatomical arguments and common sense, it has been much overlooked by the generality of authors. Some, indeed, have mentioned it; but the many advantages resulting from it have never been fully taught by any author, so far as we know, be-

fore Mr Pot ; to whose judicious observations on this and other subjected, surgery is much indebted.

To accomplish extension, our tractive efforts should at first be gentle, cautious, and steady ; and, as may be necessary, gradually encreased. The strength of the hands will almost always be found sufficient for this purpose ; where it is so, it is constantly to be preferred to every contrivance whatever. In fractures of the thigh-bone, whose surrounding muscles are by far thicker and stronger than any other part of the extremities, I have always, with one or two assistants, been able to effect due extension ; though, at the same time, I am far from doubting, that, in some muscular robust patients, the assistance of the mechanical powers may be found necessary ; especially when the neck of the thigh-bone is the seat of the fracture.

It is very material, carefully to attend to the proper time of operating the extension ; it should always be performed as soon after the accident as possible, previous to the accession of the tension and inflammation. If, however, these are present in any considerable degree, before assistance
has

has been procured, it will in general be prudent not to attempt extension till these symptoms are either mitigated or altogether removed; otherwise our attempts may not only prove vain, but extremely hurtful; for from such procedure an increase of the symptoms is but a natural consequence.

The tension and inflammation are most likely to be mitigated or removed by a strict observance of the antiphlogistic regimen in all its parts, particularly blood-letting. In sanguine, robust, young habits, copious blood-lettings, both general and topical, are indispensable; for no remedy whatever so effectually reduces the tone of the arterial system, or so powerfully destroys the inflammatory diathesis. As very much contributing to the same end, the application of large emollient or relaxant cataplasms to the fractured part is to be persisted in. These, in fact, are the tepid bath in its best form, whether we consider the effect or the conveniency of applying it. It may be added, the less it is compounded the better.

For determining the quantity of extension, the rule is, to proceed till the next step in the curative

rative process can be properly accomplished, viz.

COAPTATION.

COAPTATION, or setting of the reduced fragments, ought to be executed with all possible accuracy and attention; for on it the future shape, and perhaps usefulness of the limb, may in a great degree depend.

Accurate anatomical acquaintance with the structure of the parts concerned, will here be the Surgeon's best assistant; some information may be gained by carefully comparing the affected with the corresponding sound limb.

The other steps in the treatment of fractures are, as it were, only subservient to coaptation: For by extension the limb is restored to its due length; but by coaptation it regains its natural form; which we endeavour to maintain by the last step, or

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OF FRACTURES.

RETENTION.

AFTER coaptation, properly to effect the retention of the fragments, is by far the most arduous part of the Surgeon's task, in the management of fractures; unsuccessfulness in this point frustrates all his former labour, and often subjects him to the most mortifying reflections. Although the distortion and deformity, which must be the unavoidable consequence of failure here, may in justice be solely imputable to the imprudent conduct of the patient; or may be the effect of accidents unforeseen, or not to be prevented; yet the inconsiderate part of mankind, which is by no means the least numerous, will, without hesitation, state the whole blame to the Surgeon's account.

Some of the chief sources whence the difficulty of retention flows, are the following:

1. The thickness of the surrounding muscles. This circumstance, besides increasing the muscular

cular strength or contractile power, by which the fragments are displaced, adds to the difficulty in another way. By it our retentive applications are kept at too great distance from the fractured bones, whereby their influence is either diminished or totally destroyed : so that when they are made with as great stricture as is compatible with the safety of these surrounding parts themselves, little or no resistance is opposed to the derangement of the fragments. This is peculiarly the case in the thigh ; for this reason, by Hildanus it is compared to a bone surrounded with a thick pillow.

2. The obliquity of the fracture. Nothing can be more evident than that the greater this obliquity is, the contractility of the muscles, and derangement of the fragments, will be less resisted, or the difficulty of retention augmented.

3. The unfavourable external form of the part affected. The more this deviates from the cylindrical, and approaches to the conical shape, our applications have a more unfavourable hold of the included parts. The form of the thigh is a strong instance of this observation, particularly if the patient is muscular and plump.

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4. The restlessness of patients. It is needless to observe, after what has been said, how absolutely necessary to obtain a complete cure preserving the limb steadily in one situation must be; or how easily, especially in oblique fractures, by the smallest motion, the fragments may be deranged. If, from the thoughtlessness of youth, our patients are fretful and unmanageable, they are surely excuseable; but no apology is sufficient for the peevish discontent, and provoking inattention, of such as are more advanced in life.

5. Accidents, such as convulsive startings, cough, and reaching to vomit. All these are very readily induced, in the more delicate or mobile systems, by the stimulus of the fragments; as they occasion much concussion of the whole body, they must of necessity very often derange the fragments after coaptation. To this head belongs diarrhoea; the molesting nature of which is obvious.

From these observations, the difficulty of retaining fractured bones in situ must be very evident. Indeed to effect retention properly has ever been regarded as a very important business;

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and has accordingly, at all times, afforded abundant exercise to the invention of the ingenious practical Surgeon; as will hereafter appear.

Deligation of various kinds, and Posture, comprehend the retentive means employed in fractures.

Deligation. This includes bandages of every kind, as well those made of soft materials, such as cloths of all sorts, &c. as those constructed of harder and more resistant substances, viz. leather, wood, metal, &c. called Machines.

Before giving particular directions for performing deligation, it may not be improper, once for all, to intimate, that the intention of bandages is, in transverse fractures, to protect the fragments from derangement by external causes, which alone can affect them; in oblique fractures, to resist the deranging effects of both internal and external causes, as they are affected by either. The internal cause here chiefly alluded, is the contractility of the muscles, to which the bones, in a sound state, oppose a resistance. If, therefore, by bandages in oblique fractures, a temporary
substitution

substitution to the now deficient resistance of the bones is not afforded, they must either do mischief or nothing.

From this view of the intention of bandages in the management of fractures, we must certainly conclude, that it can never be completed by such alone as consist altogether of soft and pliant materials. For this reason it is, that pieces of metal, wood, leather, pasteboard, or the like, under the name of splints, have always made an essential part of the most simple apparatus for the retention of fractured bones.

The roller-bandages, on account of the motion and disturbance which the fragments must suffer from applying and removing them, are most improper and inconvenient in the cure of fractures, and are justly superseded by two or three circular ones, put once, or at most twice, round the limb, or by bandages with eighteen or twelve tails, or others constructed on the same principle, such as are described by Scultetus and Mr William Sharp; and as, by their means, the state of the fracture can be conveniently and safely inspected, they are peculiarly adapted to the cure

of compound fractures, where the roller-bandages can have no place.

Some practitioners prefer these bandages when made of flannel to such as are made of linen cloth, from an opinion that they can be applied with greater firmness and neatness; at the same time, in case of sudden swelling intervening, they yield a little, and consequently are not so apt as the linen ones to impede the circulation.

The splints most commonly employed are made of pasteboard. When gently moistened before application, they assume, to a considerable degree, the shape of the part over which they are applied; and thus very much favour and facilitate the retention of the fragments; which indeed is chiefly effected by the action of splints; the bandages may be considered as only subservient.

Leather-splints are extolled by some as much superior to the pasteboard ones; particularly in compound fractures, where the rigidity of the pasteboard is altogether destroyed by the matter discharged from the wounds, and by the moist applications that may be necessary. This is undoubtedly

doubtedly true; but in such cases any of them of the common form are much inadequate to the task.

Whether pasteboard, leather, or metal splints are employed, they ought to be long enough to reach the full length of the fractured bone, or from the joint above to the joint immediately below the place of the fracture. At the same time that these long splints very much contribute to secure the fragments against alteration, they press less than the short ones commonly used, on the place of the fracture where the inflammation and pain are greatest.

As to the requisite number of splints, two of proper form and breadth are sufficient. They are to be lined with thick compresses of folded linen or flannel; stitching these to the splints greatly facilitates their application. On the back part of one of the splints, ought to be fixed, at proper distances, several straps of strong tape, of such length as to be able to surround the limb, and tie over the opposite splint. These become the circulars already mentioned.

Splints intended for the leg must have a hole

or

or excavation in their lower extremities to receive the ancles; these contribute a good deal to render more effectual.

If splints thus constructed are properly applied, scarcely does any further bandaging seem necessary; for it is doubtful if by it the security against alteration of the fragments can be increased. If, however, any more shall still be thought proper, the bandages mentioned above are undoubtedly preferable to those of the roller-kind.

Posture. It is a very material point, after having proceeded thus far, to contrive a method of reposing the diseased limb, that may equally quadrate with the curative intention and the patient's ease.

When treating of extension, it was observed, that a relaxed state of the muscles very much facilitated the reduction of the fragments; that posture of the limb, therefore, in which the greatest number of muscles are relaxed, is here to be carefully consulted; especially if the patient is muscular;

muscular, and the fracture oblique, because it equally favours retention.

If the fracture is ascertained to be of the transverse kind, after the coaptation is properly executed, I know no reason, of any force, why the relaxed state of the muscles should be much regarded: on the contrary, perhaps, their being constantly on the stretch, by firmly opposing the ends of the fragments to one another, may not a little contribute to retention.

When the arm-bones are fractured, the relaxed state of the muscles is naturally and universally adopted. To say any thing farther on this part of our subject, is therefore altogether unnecessary. When the bones of the lower extremities are fractured, it is much more difficult to obtain the relaxed state of the muscles. Mr Pot rests the successful cure of fractures, those of the thigh-bone not excepted, almost totally on the observance of this circumstance: he directs the patient to lie on the side which corresponds with the fractured limb; by which means the limb being laid on its side above a pillow, the knee-joint can be kept in a state of flexion to the requisite degree.

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It may be objected to this posture of the leg and body, that properly to obtain it is often impracticable. For this purpose, the matrafs-bed, on which the patient lies, should be of an equal hardness in every part, that his body and leg may remain, during the whole cure, in the same plane: for if the body sinks more than the leg, (which it always does when laid on beds constructed with the ordinary materials, such as feathers or chaff), they soon come to be in very different planes; and thus there is danger of distorting what we meant to rectify. In hospitals, indeed, such equally hard matrafs-beds may be purposely constructed; but in common practice the case is very different.

Admitting this difficulty, respecting the inequality of the bed, to be surmounted, it may still be said, that lying on the side becomes much sooner irksome than on the back; because, in the former situation, the weight of the body is sustained by a less and more unequal surface than in the latter. The arm also of the side on which the patient lies, is so much hampered and confined, as to prevent him from taking diet or medicine, though placed within his reach. That to patients labouring under fractures, a situation as
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little irksome and inconvenient as possible should be chosen, is highly expedient; when it is considered, how tedious the cures often are; and that the smallest alteration of posture, for the sake of ease, will often defeat all that has previously been done.

It may be here alledged, that the patient may rest chiefly on his back, and keep his leg, notwithstanding, on its side, in a state of flexion. This obviates the objection as to the leg, strictly so called; for undoubtedly the muscles may attain to all the relaxation which posture alone can yield, while the patient remains in a supine situation. This is, however, by no means the case with the thigh; for unless the patient really inclines very considerably to the side, the strong musculi adductores femoris will in some degree be kept on the stretch. When the fracture is in the neck of the thigh-bone, or near its trochanter major, how much this circumstance must counteract the curative intention, it is easy to conceive. Wounds attending fractures situated on the external parts of the leg, altogether preclude the side-posture, while the usual plan of management is adopted.

Surgeons hitherto have been more employed in adapting their patients, by posture, to the ordinary form of beds, than of altering and accommodating this form itself.

The relaxed state of the muscles of the thigh and leg can be obtained, while the patient lies freely on his back, by the following method; against which fewer objections seem to lie than against the other. I have known patients remain nine or ten weeks very steadily on their backs; but never any for half that time with such constancy on their sides.

In fractures of the thigh-bone, the patient's body is to be elevated a foot or eighteen inches above the general surface of the bed. The simplest method of effecting this, is to double up the proper matras of the bed, so as that the legs, from the knees downwards, may project over the doubled part of it, to allow of the flexion of the knee-joints. By placing the patient in this way in the day-time, the body, by means of a bed-chair, pillows, &c. may, without occasioning the smallest disturbance to the fragments, (unless the fracture is in the neck, or very near the upper part of the bone), be raised to the sitting posture. How
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OF FRACTURES.

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soothing this alteration must be, and how much it will diminish the irksomeness of long confinement, is easier to be conceived than expressed.

When the fracture is situated below the knee, the leg, from the knee downward, is to be raised and kept in a plane fourteen or fifteen inches higher than the surface of the bed, that the knee-joint may admit of such a degree of flexion as is sufficient for relaxing the muscles. The height of the one plane above the other, both for the thigh and leg, must be varied according to the size of the patient. This elevation of the leg can be easily effected, by placing pillows above one another, or by any other contrivance which time and place may suggest. By this method also the patient may be regaled with the same alternation of posture proposed above.

If the dependent situation of the leg, when the thigh is placed as described, should be found to induce swelling, or to increase it, it may be raised nearer to the level of the body, without much disadvantage; for a considerable variation of the angle of flexion has but little influence in stretching or relaxing the femoral muscles.

The only circumstance that can render the position of the thigh and leg above mentioned impracticable, is the accident of wounds in their back-part: in this case, the other method must be adopted. By means of a flat basin and urinal, the fœces and urine can be received with abundant convenience, whether the patient be placed in the one or other of these ways.

OF

OF FRACTURES IN THE THIGH-BONE.

THE difficulty of conducting the cure of fractures of the thigh-bone is known and confessed by all. The genius and invention of the best Surgeons have been much exercised to devise a method of treatment by which this might be obviated. However, as the number of fractures of this bone is almost equalled by that of consequent deformities, such as short and decayed legs, &c. the proof that their labours have hitherto been much unsuccessful is but too plain.

Thickness and strength of the surrounding muscles, together with the conical shape so peculiar to the thigh, principally create the difficulty of retention, which always occurs in fractures of this bone. When with these are conjoined obliquity
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of fracture, and the accidents so often defeating our retentive applications before mentioned, the task becomes more and more arduous.

Fractures in the neck of this bone, which, on account of its obliquity and spongy texture, happen much oftener than was formerly imagined, are, from its natural situation, always oblique, with respect to the common axis of the bone, and the direction of the femoral muscles. This circumstance renders the retention of fractures here more difficult than in any other part of this bone.

The grand desideratum is, by some means or other, to create a temporary substitution to the now-deficient opposition which was afforded by the bone to the contractility of the femoral muscles, as well as to prevent derangement of the fragments from any accidental motion of the leg or body. Any apparatus or mode of deligation for a fractured thigh-bone, incapable of completing these intentions, is evidently very much defective.

This substitution to the deficient resistance of the bones can only be made by assuming two fixed

ed points, the one above and the other below the place of the fracture, which are to be maintained at the same distance from one another which they held after coaptation, till the reuniting callus is sufficiently confirmed.

Upon this principle we reject the spica-bandage, junks, and the like, as altogether unequal to retain the fragments in the situation in which they were placed by coaptation. The patient would undoubtedly be less tormented, and the deformity would not probably be greater, were the case after coaptation entirely committed to nature, and no trial made towards a cure by such inadequate and preposterous means as the common practice employs.

The method of placing the fractured thigh on its side, as directed by Mr Pot, and trusting the retention altogether to this posture, I am much inclined to regard as doing little more than leaving it to nature. In oblique fractures especially, the contractility of the strong and numerous femoral muscles forbids us to expect retention from posture alone, however well contrived. Indeed splints secured with the ordinary bandages are not neglected ;

neglected : however, for the reasons adduced, the additional security resulting from these is very inconsiderable. Keeping the muscles, as much as may be, relaxed, by the method already recommended, no doubt contributes considerably towards retention, by somewhat shortening the line of their contractility, and rendering them less apt to pull the fragments over one another than when the leg is fully extended in the same plane with the body ; yet such long muscles are still capable of contracting much more ; and always do so as soon as the fragments lose their opposition ; and the resistance to their further contraction is thereby in a great measure removed.

From these observations it follows, that if retention of the fragments of the os femoris is at all to be effected, it must be by some rigid splint or machine, assisted by posture, calculated to fulfil the purposes above enumerated, with as great safety to the parts, and ease to the patient, as possible.

Such splints or machines only are here understood as are consistent with the relaxed state of the muscles, whether to obtain it the patient lie
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on his side or on his back ; therefore the above conclusion by no means contradicts what Mr Pot says in the following passage ; where, apprehending that such assistances were inconsistent with keeping the muscles relaxed, and resolving to confide in posture only for a perfect cure, his words are : “ If I meant to describe, or if I approved, “ (pardon the phrase), the common method of “ placing the broken leg and thigh in a straight “ manner, this would be the place to mention “ the many very ingenious contrivances, and pieces of machinery, which practitioners, both “ ancient and modern, have described, for the “ purpose of keeping the whole limb straight “ and steady ; that is, of keeping all the muscles surrounding the fractured bone upon the “ stretch, and at the same time of preventing “ any inequality in the union of it, and any shortening in consequence of that inequality ; but “ as my intention is to inculcate another, and, as “ it appears to me, a better disposition of the “ limb, in which such boxes, cradles, and pieces of machinery, are not wanted, or cannot “ be used, it is needless to say any thing about “ them.”

I shall take the liberty to make a few remarks on some of the machines which have been recommended to accomplish retention of the fractured os femoris.

The case of a young girl, who, by a fall from a house-top, had fractured her thigh-bone, is narrated by the celebrated F. Hildanus. The fracture was near the upper part of this bone, the leg was considerably shortened; and, from the overlapping of the fragments, a large tumor was perceived at the place of the fracture. Extension, coaptation, and delegation were performed; and, for fourteen days, every thing succeeded to his wish. In the night-time, soon afterwards, however, she had altered the situation of her body, by which the fragments were displaced; so that, on visiting her in the morning, he found her leg shortened, and the tumor returned. Extension, &c. were repeated, and the same accident followed: he now despaired of success, and thought it vain to make any further attempts towards a perfect cure.

When in this predicament, he happily contrived a machine; the invention of which (with
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more devotion than falls, I am afraid, to the lot of many of his modern brethren) he piously ascribes to the inspiring aid of Heaven. By it he effected perfect retention and cure.

This machine consists of an iron plate, of sufficient length to reach from the top of the pelvis to below the knee; properly hollowed, to receive the external part of the thigh, and lined with soft materials. It is provided with three belts; one is fixed round the pelvis; the other two round the leg, the one immediately above, the other below the knee.

Though this machine, to retain the fractured thigh-bone, is deficient in some necessary qualities, and seems chiefly to act by pressure on the place of the fracture, and that during the extended posture of the leg; yet it is by far more likely to effect the retention of the fragments of this bone, than the bandaging commonly employed, particularly than junks. It is surprising it has not been oftener made use of. By omitting to tie the belt, which passes below the knee, it permits flexion of the knee, with a view to relax the muscles, in whichever of the two positions above men-

tioned the leg is placed. This is an advantage not attended to by its author.

The following passage from Dr James's Medical Dictionary is not foreign to our subject. After remarking the difficulty of retaining the fragments of this bone in situ, he says, "It would be worth while to invent a machine to preserve a fractured thigh in due extension, so that the injured limb may be kept of the same length with the other, for fourteen days or more, or indeed during the whole time of the cure; for then you might reasonably expect a certain and more successful conglutination. Though Hildanus has described an instrument proper for the extension of oblique fractures; yet it is to be feared it is something imperfect. In the mean time, since we are without a better, and the method by bandage is not thought sufficient, it will not be amiss to apply that machine of Hildanus," &c.

The next I shall mention is one invented by M. Belloq, a very ingenious Member of the Royal Academy of Surgery in France, approved of by that learned and respectable body; and which M. Belloq

Belloq found to succeed in two cases of oblique fracture of the os femoris, after he had in vain tried the bandaging apparatus commonly employed in such cases.

M. Belloq calls it a Mechanical bandage. It can only be applied when the leg is in an extended posture; therefore, according to our principles, it cannot be here recommended. Independent of this objection, its very complex, though artful construction, will, we are afraid, prevent it from ever being adopted by the general practice.

The very ingenious Mr Gooch, an eminent Surgeon in Norwich, has invented and recommended a machine, expressly calculated to perform retention of the fragments of the os femoris. It consists of three jointed circulars, lined with soft materials to surround the limb. The upper one applies to the upper part of the thigh; the other two are connected together; the one fixes above the knee, the other below it, the better to divide the pressure: they are therefore only to be regarded as one. This and the upper one are connected by two pillars, one on each side of the thigh,

thigh, so contrived, that by turning screws they are elongated at pleasure; and the two circulars are farther removed from one another : and thus the intervening portion of the thigh in which the fracture is supposed to be, is kept extended to its natural length, and a substitution provided against the action of the muscles, in place of that which the bone in a sound state afforded. His own account of it is as follows :

“ How to keep a fractured thigh duly extended, particularly in adults, has exercised the thoughts of some of the ablest Surgeons ; and it is a point of great consequence to be well effected :

“ Several years ago, I had a machine made for this purpose, according to a sketch I drew of it before ; and soon had a fair opportunity of trying its usefulness. It answered my design the first time I used it beyond my expectation, in a very bad oblique fracture, attended with a vexatious cough, which occasioned extreme pain by shaking the limb, and deprived the patient of his rest : it kept the part, sensibly to himself, in a gentle extension, and the limb in a steady posture,

" posture, so that it was not the least affected by
" the cough afterwards ; which before, accord-
" ing to his own expression, gave him such a sen-
" sation of pain, as if the ends of the bones were
" thrusting into the flesh. This machine being
" lined with soft oiled leather, and well stuffed
" with wool, sat very easy on the part, without
" causing any excoriation. Pieces of buff-leather
" will defend the limb against the machine, as
" well as the other lining and stuffing, as has been
" particularly tried ; but very particular cau-
" tion is necessary, to guard the inside of the
" thigh.

" This machine is very simple in its construc-
" tion, and intended to maintain its power up-
" on the limb in any posture necessary to put it
" or the body in ; and I hope the repeated trials
" of other Surgeons will farther confirm its u-
" tility, even in fractures upon the neck of the
" bone.

An objection to this machine is, that it cannot
safely be brought to act with force sufficient to re-
sist the contraction of the muscles, because of its
upper circular, which being entirely fixed on the
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soft muscular parts of the thigh, not only the circulation of the limb in general, but that in the great vessels which run on the inside of the thigh in particular, is in danger of being much impeded; and so swelling, inflammation, and perhaps gangrene of the whole leg, induced, unless provided against with the greatest circumspection. The author himself indeed acknowledges, that "great caution is necessary to guard the inside of the thigh."

Though the upper circular thus embracing the thigh in its upper or middle part, where the circulation is altogether unprotected against its action, creates an objection to this machine, this cannot be said of its lower one, which is prevented from sensibly impeding the circulation, by the ham-strings, or tendons of the flexor muscles of the leg, between which the crural vessels pass securely. The two circulars connected inflexibly together, however, render the flexion of the knee-joint, and consequently the relaxing of the muscles, impossible.

When the neck of this bone is fractured, the trochanter major is drawn upward on the lateral
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and back part of the pelvis, considerably above the acetabulum, by the contracting muscles. To this circumstance the shortening of the leg, always consequent to fractures here, is owing. As Mr Gooch's machine does not lay hold of the pelvis, but of the thigh itself, it is to be feared, that in this case it would not properly effect retention, although it could otherwise be used with the greatest safety.

Having thus (with the same candour with which I wish my own proposals may be tried) examined the several contrivances for accomplishing retention of the fractured thigh-bone, which bade fairest for success, and found them inadequate, inconvenient, or unsafe, with deference, I next proceed to propose and describe other machines for performing this important business, against which none of the objections produced above, or any others of equal weight, as far as experience or information have yet shewn, can fairly be made; which I fondly hope the candid experience of my ingenious brethren will farther improve and confirm.

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It has already been observed, that a proper and necessary resistance to the constant contractile nifus of the femoral muscles, now that the bone is fractured, can only be supplied by assuming two fixed points, the one above and the other below the fractured part; which are to be maintained at the same distance they held naturally, or immediately after extension and coaptation were duly accomplished.

The pelvis offers itself as the most proper part on which to assume the superior fixed point; because here the circulation and internal organs are protected from any pressure that may be consequent upon doing so. Its situation also, as being above the neck of the thigh-bone, is an additional recommendation. The lower part of the thigh, or ordinary gartering place, for reasons already alleged, is to be chosen for the inferior one. About each of these a belt or circular is applied.

The circular which embraces the pelvis occupies the same place where the top-band of the breeches in men is fixed, and with much the same strictness, and resembles it pretty much in shape; the other circular applies above the knee, with about

About the same tightness which the garters commonly have. These constitute the two fixed points, and are the basis of the resistance to the muscular contraction which we mean to produce; their particular structure and application shall be taught hereafter.

Graduating steel-splints, three or more in number, connect these circulars in such a manner, that the intercepted portion of the thigh can be kept more or less extended at pleasure, with abundant steadiness and safety; and that even in spite of the motion which may be occasioned by convulsive startings, coughing, reaching to vomit, &c. for any length of time, and with equal facility and success, whether, to obtain the relaxed state of the muscles, the patient lie on his side or back; and, which is of the last importance, this mode of dressing a broken thigh-bone, causes as little pain or uneasiness, as well when applying as afterwards, as any other apparatus whatever, that is likely to be productive of the smallest advantage. While all this is accomplished, the circulation is in no degree obstructed; as any one, ever

so little acquainted with the anatomy of the parts concerned, must know.

Previously to any further explanation of what I am inclined to regard as peculiar advantages resulting from the use of this machine for retaining the fractured thigh-bone, it may not be improper to give such a particular description of its parts, and mode of application, as may enable such as chuse properly to construct and apply it.

The largest circular, or that which furrounds the pelvis AAA, (Plate I. Fig. 1.), consists of a piece of thickish saddle-leather; its breadth, when intended for an adult, may be from three to four inches: in one end of it are three or four fluds, which have as many corresponding holes in the other end, by which it is buttoned or fastened round the body. These holes are continued backward, one after another, at small distances. By this simple artifice, its circle can be augmented or diminished, so as to accommodate itself to pelves of different sizes, or with different degrees of strictness to the same pelvis.

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This leather circular, all except its perforated part, and about a quarter of an inch on each edge, is covered on the inside with a flexible thin iron-plate, such as is sometimes used by tin-plate-workers. It has two obscure joints in that part which answers to the back; these allow it to open and receive the body with the greatest ease.

Over this iron-plate, the circular is lined with the softest buff or shamoy leather; between which and the plate a thin layer of hair or wool is interposed. The lining ought to project on both sides over the leather half an inch, or more, to prevent it in any degree from pressing on the skin. The lining is stitched all round to the edges of the leather, to which the iron-plate does not extend.

It is most convenient to throw the opening of this circular to one side of the os pubis. After it is applied, to prevent it from moving upwards; (which the shape of the pelvis, and the pressure made from below, hinder from happening downwards), two thick stuffed straps BB, fixed to its back part, pass between the thighs from behind, to tie,

tie, by means of their forked ends, to its fore-part. As almost the whole resistance to the shortening of the thigh falls ultimately on these straps, it is of consequence that they be thick and well made: if they should, notwithstanding, at any time, be found to fit uneasily, a soft-folded cloth, or the like, can be put betwixt them and the skin.

From the above description, it will now be evident, that this whole circular is constructed on the very same principle, applied and secured to the very same places, and in the very same manner, as the common spring rupture-bandage. The first idea of it, indeed, was suggested by observing with what ease and immoveable firmness a young man I had under my care for an hernia intestinalis wore one, during great exercise, and for a great length of time. The chief difference between the two is, that the circular is much broader and thinner, and tied down to the pelvis by two thick straps in place of one, that it might less incommode the patient while lying on his back, and the better divide and resist the pressure from below, and act as a fixed point, without proving irksome. It applies equally well, whether the

the body is naked or covered with shirt, waistcoat, breeches, &c.

The small circular *dd*, or inferior fixed point, is exactly similar to the large one in structure, the tin-plate excepted, which, on account of its smaller diameter, was found to be unnecessary. As was said before, it applies round the inferior part of the thigh, or gartering place, with the same or somewhat less straitness, than that with which the garters are commonly worn. It must not, however, be so slack as to get over the rotula and knee-joint. Some folds of soft flannel are, previously to the application of this circular, put round the part which it surrounds.

By means of three or more graduating steel-splints *ccc*, passing between these two fixed points, thus established, to preserve them at the requisite distance from one another, the advantages derived from extension and coaptation are fully maintained, or perfect retention of the fragments is effected.

These splints must be sufficiently long to extend from the upper circular to the lower one, and

and to project over it about a hand-breadth. They answer very well, when made about four or five eighth parts of an inch broad, and about one eighth-part of an inch thick; that they may be rigid enough to resist any violence tending to shorten or otherwise derange the limb and fragments; and at the same time so flexible, that they may be readily bended with the hand, and made to assume any degree of curvature in any part of them which may be found necessary.

Each splint has a hole or slit in its upper end, about half an inch long, and one eighth of an inch in breadth, to receive the flat head of a stud planted in the upper circular, in such a manner as to allow of motion round its axis, for fixing the splint.

The inferior end of the splint passes through an iron screw-plate, which is firmly riveted to the lower circular. The screw has a flat broad head, that it may be easily turned with the fingers; and its point fitted to catch in some one or other of the impressions purposely made in the splint at small intervals. It is easy to perceive, that by this

this means the distance between the circulars can be regulated at pleasure, and, when determined, firmly maintained.

It will now be also very apparent, that by making several such graduating splints to pass from the one circular to the other, at proper distances, we form, as it were, a breeches-thigh, rigid enough to oppose unfurmountable resistance to the muscular contraction, or any ordinary accident tending to alter the coaptation of the fragments; which, notwithstanding, is at the same time dilatable at pleasure, in every dimension.

As to the requisite number of splints, I have from experience found three answer very well. One passes from the upper circular opposite to the os pubis, to the inferior circular at the internal and back part of the thigh, immediately above the knee; another from opposite to the anterior spine of the os ileum, to the fore-part of the inferior circular immediately above the rotula; a third from above, and a little back from the acetabulum, to the external and back-part of the thigh, immediately above the knee. If more of these splints should be found to be necessary,

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they can be occasionally added in the intermediate spaces.

From the above description, where, I hope, I have expressed myself intelligibly, it will be evident with what security and facility this machine may be employed, to effect retention of either thigh, or of both at the same time.

When this machine is properly applied, all motion of the thigh on the pelvis is totally suppressed; which will be found to be a circumstance highly favouring retention; more especially if the fracture is in or near the neck of the os femoris.

As this method of retention is effectual, independent of the assistance of any other bandaging whatever; by making the splints to arch properly outwards, the necessary applications to all the thigh, or to wounds in any part of it, may be made, without in the least disturbing the fragments, or paining the patient. Its extensive use in the treatment of compound fractures of this part, requires no farther illustration.

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The advantages that may result from the use of this machine in the management of wounds of the thigh, with loss of substance of the bone, (which may happen from various causes, particularly the different species of caries), will also be abundantly obvious. However, more fully to illustrate this observation, the following case is adduced, in which, if I am not much deceived, the patient would at least have reaped much ease and relief from this apparatus.

“ A student, at the age of twenty, for several years had an ulcer with caries in the middle and internal part of his thigh, where the crural artery descends. The caries, from the thickness of the flesh in this part of the thigh, was invisible; neither could the ulcer be enlarged with the knife, or the bone cauterised, on account of the vicinity of the great artery; so that all the medicines that were applied proved ineffectual. At length, in walking, without any external violence, the thigh was broken in this very part. Here, again, we could neither enlarge the wound, or cauterise the bone, for the reasons above mentioned; and although the bone was reduced, and a proper bandage applied, yet it would never heal, and the

patient led a miserable life. It is therefore the duty of every one to consider how such a fracture should be treated," &c.

While speaking of the advantages of this machine, it may be mentioned, that by its use the ordinary time of confining the patient to bed may be much abridged; for, with it applied, he may much sooner venture to rise than would otherwise be prudent.

Another machine (Plate II. Fig. 1. & 2.) deserves to be described. The principal part of it, (Fig. 1.), formed of tin-plate or thin copper, is so excavated, that it applies to the outside of the fractured thigh, to which it should be accommodated in size, &c. as nearly as possible. It may be lined or spread over with any soft material, such as flannel, tow, or wool. It must be of sufficient length to reach from the spine of the os ileum to below the knee. The inferior extremity of it is accordingly adapted to the knee in a state of semiflexion: A circumstance which contributes much to the retention.

This part being justly applied, the other piece,
(Fig. 2.),

(Fig. 2.), lined properly like the other, is fitted on the opposite part of the thigh; its upper end reaching to the groin, and the inferior one of it, as represented, may extend to the knee; or it may be longer, and adapted to the knee in a state of semiflexion. By means of the belts, or strong tapes BBBB, the two pieces are firmly bound together, so as to give a uniform compression, which greatly favours retention.

If this machine should be found to be less retentive than the other, it compensates for this deficiency by its simple structure, which is a great recommendation in favour of any apparatus.

Both these machines apply equally to the simple and compound fractures of the thigh-bone.

OF FRACTURES IN THE LEG-BONE.

THE difficulty of effecting due retention of the fragments of the leg-bones, after coaptation, is far from being so great as that of the fractured thigh-bone is shewn to be. However, if fractures here are much oblique, attended with wounds, or followed with high inflammation, supuration, &c. the retentive part of their treatment is by no means easy to be accomplished. Any considerable loss of the substance of the bones still renders this business more difficult. Of this last assertion the following case will furnish an illustration.

A man, who by a fall from a great height had received a very bad compound fracture of the leg, with the tibia considerably protruded from the wound,

wound, was put under the care of M. Vernier, an able Surgeon. After coaptation, he found it impossible, by the ordinary bandages, to effect retention of the fragments; and gangrenous symptoms supervened in consequence. After these were mitigated by proper remedies, M. Vernier again attempted extension; but, on account of the remaining swelling, this, in a due degree, was found impracticable.

On the twentieth day from the accident, the assistance of M. Coutavos, of the French Academy of Surgery, (by whom this case is published among the Academy's memoirs), was obtained. Upon careful examination, M. Coutavos found a portion of the tibia, above five inches in length, almost quite detached. With the necessary precautions, this was extracted; the fragments of the fibula were observed to pass one another above four inches; the leg was shortened in the same degree; notwithstanding the use of a machine invented and recommended for the retention of fractures, by M. la Faye; which will be hereafter mentioned.

In

In this situation, the patient suffered such intolerable pain from the stimulus of the pointed fragments, that M. Coutavos found it absolutely necessary to procure extension of the leg, by some means or other; which he accordingly attempted, in the following laborious manner.

Lacs, properly made, and passed under the patient's arms, between the thighs, and below the knee of the fractured leg, were fixed to the head of the bed-frame, with a view to secure his body from yielding to the extending power; which was applied by means of another lac passed round the ancle, which could be stretched at pleasure, by an axis in peritrochio planted at the bed-foot. By gradually increasing the extension in this manner, the limb at last regained its natural length.

After the patient had remained in this racking situation for fifteen days, M. Coutavos ingenuously confesses, that, by the strictness of the lac at the ancle, so great swelling of the foot ensued, as made it absolutely necessary to diminish the extending
force;

force; in consequence of which, the leg was again shortened above an inch.

Both by experience and probability, I am encouraged to propose a machine, (Plate II. Fig. 3. & 4.), constructed on the very same principle with the one recommended above for the thigh; which bids fair to effect retention of the fractured leg-bones with the greatest possible ease and safety, where-ever this is by any means practicable.

In this machine, the graduating splints, made rather longer than the leg from the knee downwards, to which they are to be applied, are connected at their lower extremities, by means of flat-headed vertible studs or pins, to the sole of a shoe laced before, otherwise of the ordinary form, (Fig. 4.); or with the quarter-heel protracted in the form of a half-boot, (Fig. 3.), the better to embrace and lace round the ankle and inferior part of the leg.

The other extremities of the splints are fixed in the screw-plates of a circular, exactly similar

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lar

lar to the inferior circular of the thigh-machine before delineated, applied below the knee.

The fore splint is made forked, or with an opening at the lower extremity, (Fig. 3. & 4.), of a compass sufficient to receive, but so as not in the smallest degree to press upon the fore-part of the foot. This circumstance contributes greatly to the security of the foot against lateral motion.

The intention of the shoe's having a laced opening before, (in whichever of the two forms it may be made), (Fig. 4.), is, that the foot may be lodged in it, with as little pain to the patient, or disturbance to the fragments, as possible. When this is done, the opening is to be accurately secured with the lace. The foot is previously to be involved in a piece of soft flannel, or covered with a stocking-foot, as well for the sake of softness as warmth. At first I made use of this machine constructed with a circular, which fixed about the leg at the ancle, (Fig. 2.); but
from

from repeated trials have found the shoe to answer better in every respect.

It will readily be understood, from the description of this machine, how effectually, by its means, the retention of all compound as well as of simple oblique fractures of the leg may be effected with the greatest convenience and safety : By bending the splints a little outwards, it allows the wounds to be inspected and dressed with the greatest ease, in whatever part of the leg they may be situated ; by laying hold of the fore-splint with one hand, the Surgeon can raise the leg, alter its situation when necessary, shift the dressings or bandages, without the help of an assistant, and, what is of much greater consequence, without giving the patient the smallest degree of additional pain. It seems to me highly probable, M. Coutavos would have assisted his patient as much, or more, by this instrument, than the method he pursued.

I have frequently used with great success, as well in the simple as compound fracture of the leg-splints or demi-boots represented in Plate III.

This, like those for the thigh before described, may be made of tin-plate or thin copper; either of which, under the hammer, readily assumes the proper excavation the more accurately they are adapted to the fractured leg, they are the more retentive. Any vacuities between them and the surface of the leg may be filled with tow or wool, which prevent them from being irksome, while, by rendering them more equally compressive, their retentive effect is encreased.

When two of these splints are properly applied, and secured by the belts, or tapes of sufficient strength, it is manifest they must produce absolute retention; because, by laying hold of the knee-joint and the foot, and detaining them at a specific distance, it cannot be otherwise.

To enable the same splints to apply to legs of different sizes, they may be formed and furnished with graduated splints, as represented in Plate IV.

I have found one of these splints duly retentive even of the compound fracture. To allow the matter discharged from the wound (which is often

often in great quantity) to drill off, holes of any shape or number may be formed in any part of it that may be deemed the most suitable. When it is necessary to turn or raise the leg, it will be necessary to apply two:

I shall only add, that when one, at any rate when two are applied, the retention may be entirely effected, without the assistance of any bandage; for the knee-joint, the leg and foot are completely encased, and relative motion entirely prevented.

It does not appear to me to be possible to devise a more simple plan of retention, unless, as many Surgeons do, I think from indolence, we lay the limb on a pillow, with the ordinary bandages; which is in fact abandoning the chirurgic cure altogether, and literally leaving the case to Nature; which practice is nineteen times in twenty followed with deformity and disability, more or less considerable:

In all simple and compound fractures, these instruments supersede the necessity of any other bandage, foal-piece, safe-guard, fracture-box, &c:
recom-

recommended to protect the limb from being incommoded by the pressure of the incumbent bed-cloaths.

Another advantage attending the use of these machines, not to be passed over in silence, is, that by their help the patient is in a condition to leave his bed with safety much sooner than could otherwise be attempted. I had a young man, after a compound fracture of the leg, marching through the street with one of them, within four or five weeks from the accident.

OF TRANSPORTING PATIENTS WITH FRACTURES
OF THE BONES OF THEIR THIGHS OR LEGS.

A CONSIDERATION of the exquisite tortures, which these unhappy people must suffer, who are obliged, by unavoidable necessity, to be transported, sometimes in great haste, and to a great distance, with fractures of their thighs and legs, either quite recent, or before their fragments are re-united, in a very particular manner claims the joint succours of humanity and art.

The gallant warrior, whether acting by sea or land, is peculiarly exposed to calamities of this kind. M. la Faye, an eminent Surgeon, and
Member

OF FRACTURES.

Member of the French Academy, who, it would appear, has been an eye-witness of the distressful scenes which this circumstance occasions, can best paint them. I shall therefore, without farther apology, translate part of a Memoir written by him, expressly on this subject.

“ Of all men who stand in need of the aids of Surgery, none deserve it more than those who continually expose their lives in defence of the State.

“ No spectacle can be more affecting, than the transportation of a number of wounded officers and soldiers, from the trench or field of battle to a place for dressing them. I have always, in such conjunctures, been much touched with the exquisite agonies caused by the motion of the persons employed to place the wounded in proper carriages, and of the carriages themselves, occasion to such as have the bones of their legs or thighs shattered.

“ It is difficult to move, and place in a carriage, people in this situation, without disturbing the wounded parts; but although this should be accomplished, it is impossible that they can be driven

driven for some leagues, or even half a league, without suffering the most acute pains from the shocks, which, in spite of all the bandaging about the fractures, at every movement, must displace the fragments, and make them grate on one another; thus irritating parts extremely sensible and delicate. If the pains occasioned by the transporting are lively, the consequences are not less troublesome.

“The splintered fragments, pricking and tearing the muscles, nerves, &c. already wounded, augment the swelling, inflammation, and effusions; and often occasion gangrene and mortification in consequence, which perhaps would not else have happened. These accidents are ordinarily followed with fever, delirium, convulsive startings, in one word, with general disorder of the whole animal economy. Besides this, the fragments may be so much displaced as to tear some considerable vessel, and cause an hæmorrhage not to be remedied but by immediate amputation of the member; or, if not discovered in time, the hæmorrhage may prove mortal.

“ People wounded in war, after having undergone the pains and dangers of a first transporting, are almost always exposed to new pains and fresh dangers, greater than the first, on account of the changing their situation, because of their number, or for other reasons of which the detail is unnecessary. I say, the dangers to which a second transporting exposes them are greater than the first; because the sick, having already suffered abundantly, are less in condition to support fresh fatigue; and besides, the motion of the carriage, in spite of all the precaution taken in such cases, may not only cause all the mischiefs which I have already enumerated when speaking of the first transporting, but may also, by the derangement of the fragments, and the irritation of the sensible parts, disturb the suppuration already established, or about to be so; and thus occasion a retrocession of the purulent matter: A circumstance which is known ordinarily to prove fatal.

“ The concern which one ought to take for the solace and preservation of people wounded, while generously exposing their life for the State, has excited me in a particular manner to investigate

gate means to prevent all these inconveniencies. I am instigated with the greater ardour in this pursuit, since my labours, at the same time that they are useful to the warrior, cannot fail, in like manner, to prove so to other classes of mankind, who follow perilous professions and exercises, such as masons, flaters, plumbers, lovers of the chace, &c. &c."

M. la Faye then goes on to describe a machine which he recommends for the purpose of facilitating the conveyance of the people in this unhappy situation.

Without depretiating the invention of M. la Faye, I proceed to observe, that the thigh and leg machines above described will also very well answer the same purpose. They both may be applied without stripping the patient; and when properly applied, very perfectly secure the parts against the smallest degree of alteration, even from the movement of a carriage.

In ships of war, fractures of the limbs are no uncommon accidents: the difficulties of effecting retention of the fragments, while the patients re-

main on ship-board, but more especially when it is found necessary to convey such patients from one ship to another, or to hospitals a-shore, must be fully greater than these which result from similar accidents on land. Contrivances, such as are mentioned above, are here likely to perform the most important services.

Mr Wathen, an ingenious Surgeon, has described a machine, which he calls a Conductor; purposely invented to retain fractures of the leg-bones, where it is found necessary to transport the patient. The leg-machines above mentioned are much less cumbersome than the Conductor, and perhaps give greater security.

EXPLANATION OF THE FIRST PLATE.

Fig. 1. represents a machine for retaining the fractured thigh; its structure has been already explained.

AAA, The upper circular, which surrounds the pelvis, properly stuffed, and the opening a little

Fig. 1.

Plate I.

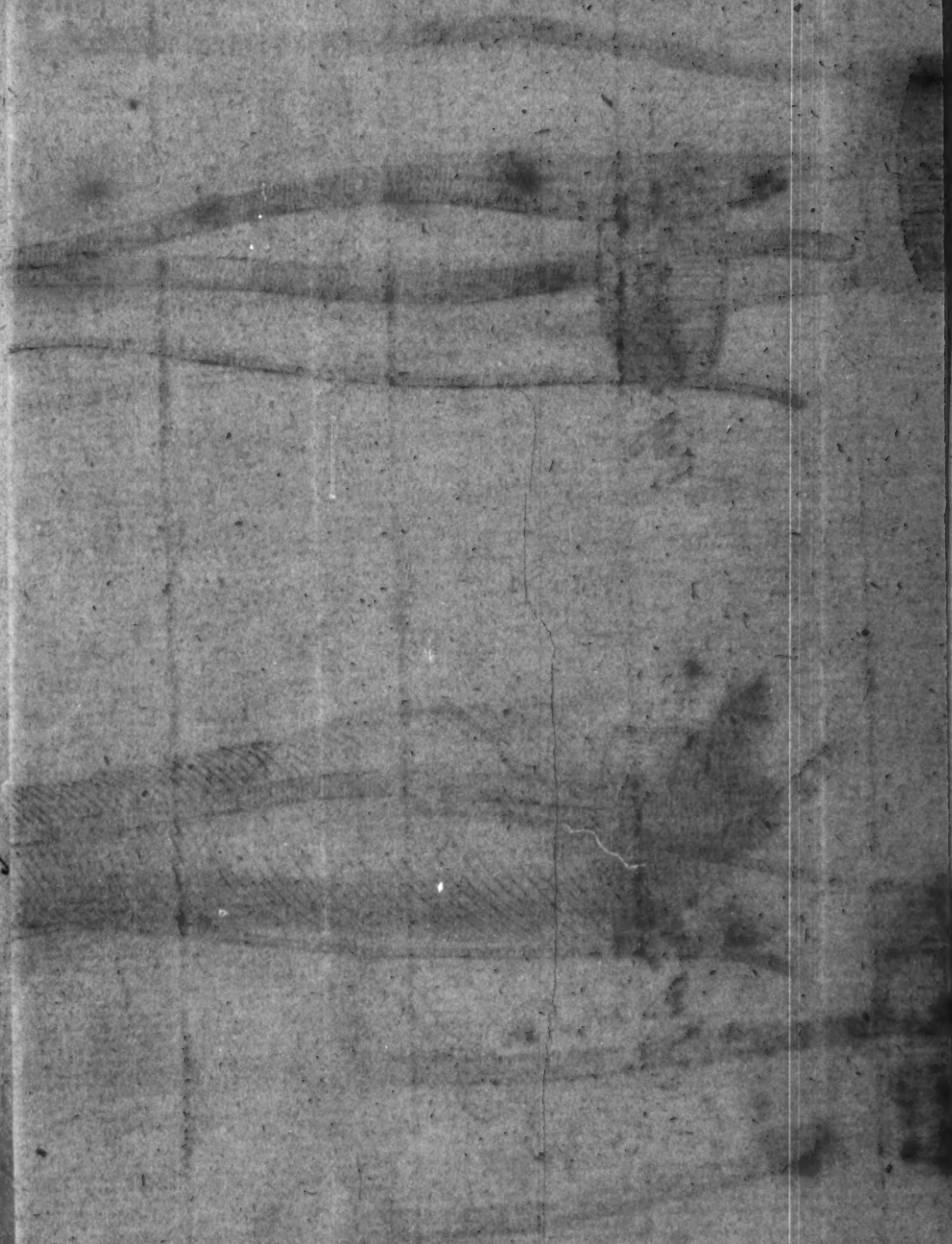


Fig. 1.

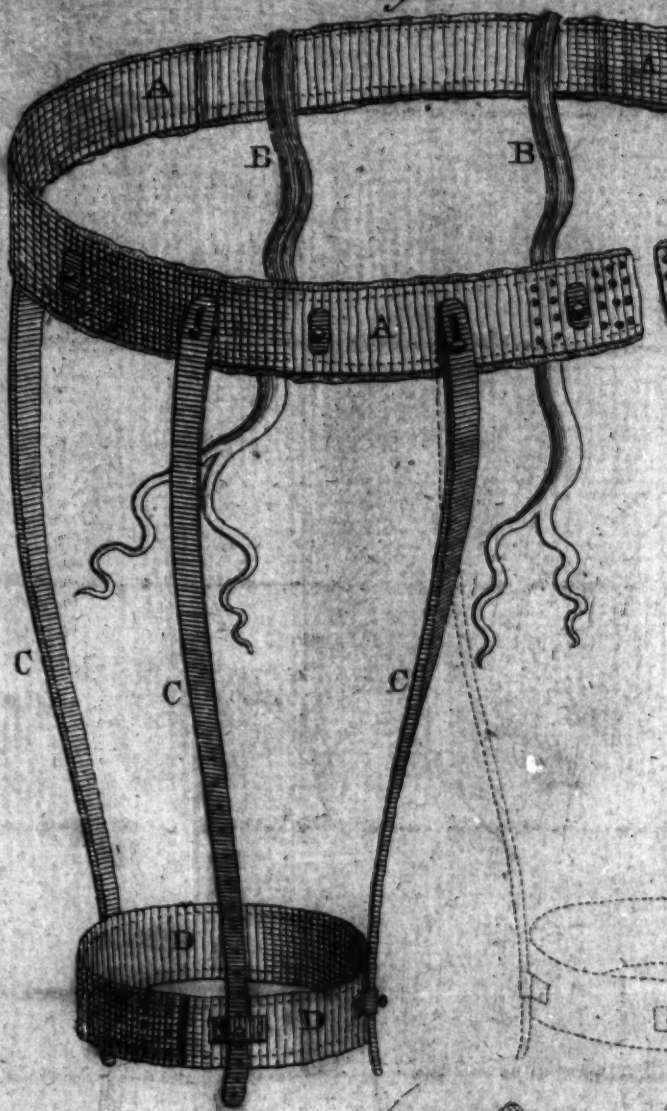


Fig.

3.

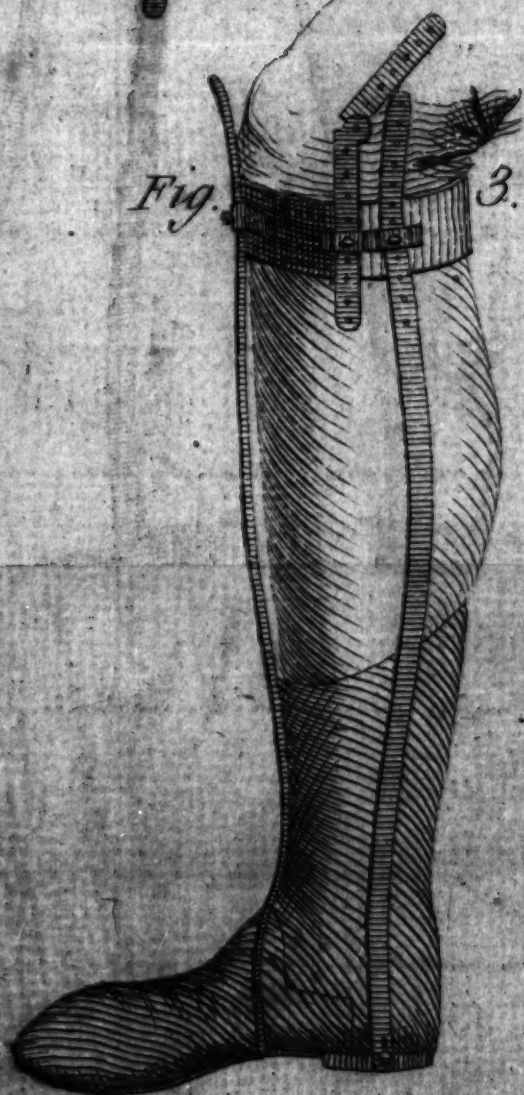


Fig. 2.

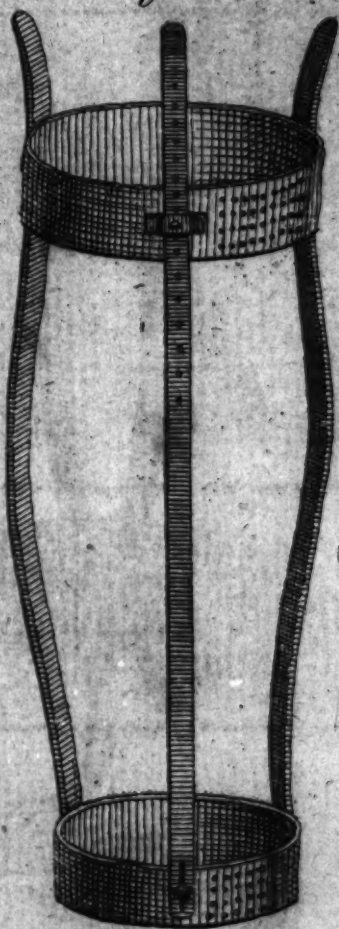
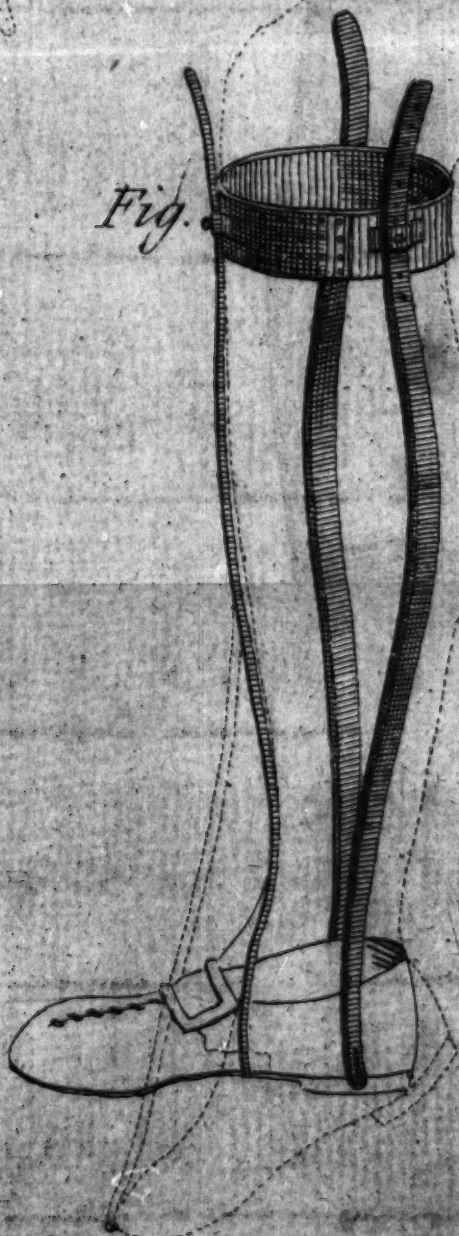


Fig.

4.



OF FRACTURES.

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to one side, to shut after it is applied by studs, which have corresponding holes. Two obscure joints are represented in its back-part.

BB, two thick and soft straps, forked at the anterior ends, to be passed from behind forward; to prevent the circular from being pushed upwards by the

ccc, graduated splints, which extend to

DD, the inferior circular, that rests immediately above the knee.

The dotted lines show how the splints and inferior circular may be changed from the one side to the other; and consequently how this machine may be adapted to either thigh occasionally, or to both at the same time.

Fig. 2. gives a view of the leg-machine, consisting of two circulars and the connecting graduated splints. The upper circular is applied immediately below the knee, and the inferior one above the ankle.

Fig. 31

Fig. 3. exhibits a leg, to which the machine delineated in fig. 2. is applied; which has a laced half-boot instead of the inferior circular.

Fig. 4. gives a sketch of the leg-machine, with a laced shoe instead of the inferior circular.

The dotted lines explain the manner in which this machine may be employed with full effect to maintain the extended position of the foot, to favour retention of the fractured tendo achillis.

EXPLANATION OF THE SECOND PLATE.

Fig. 1. exhibits an outside splint for the fractured thigh, with its hollow surface AA, properly lined or covered with soft materials: it has a flexure at its lower end corresponding to the form of the side of the knee in a state of semi-flexion.

Fig. 2.

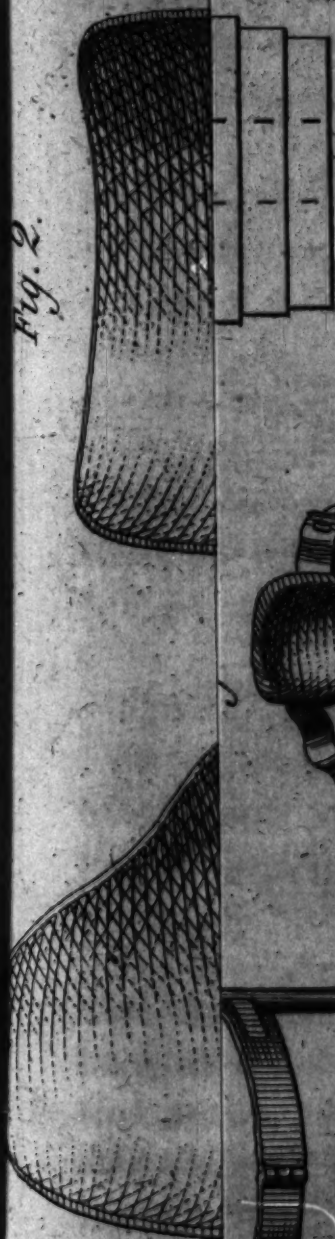


Fig. 5.

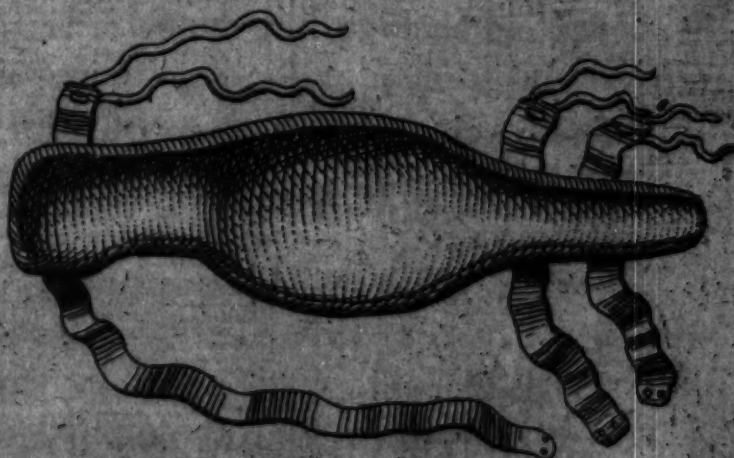
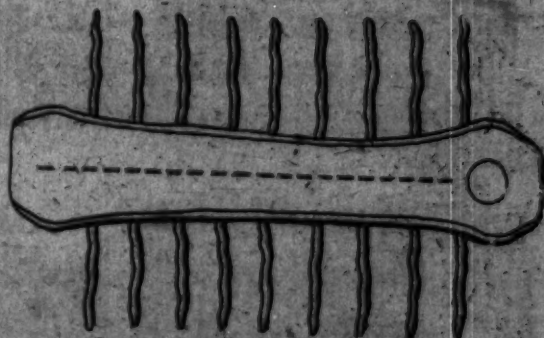




Fig. 3.

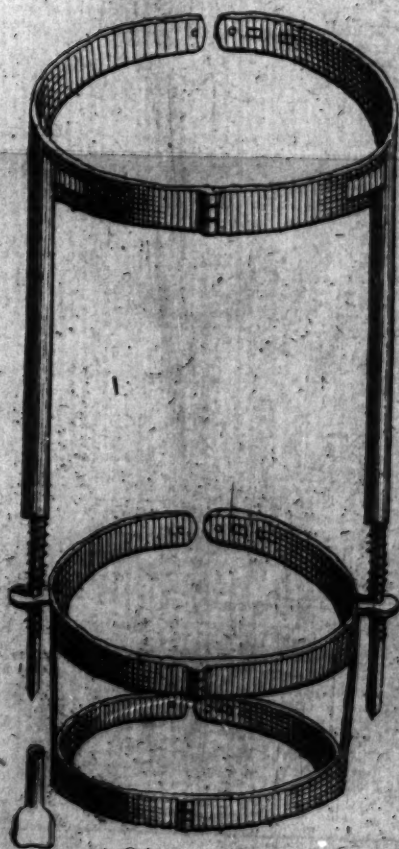


Fig.

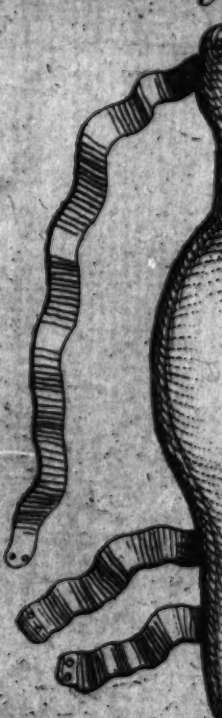


Fig. 2.

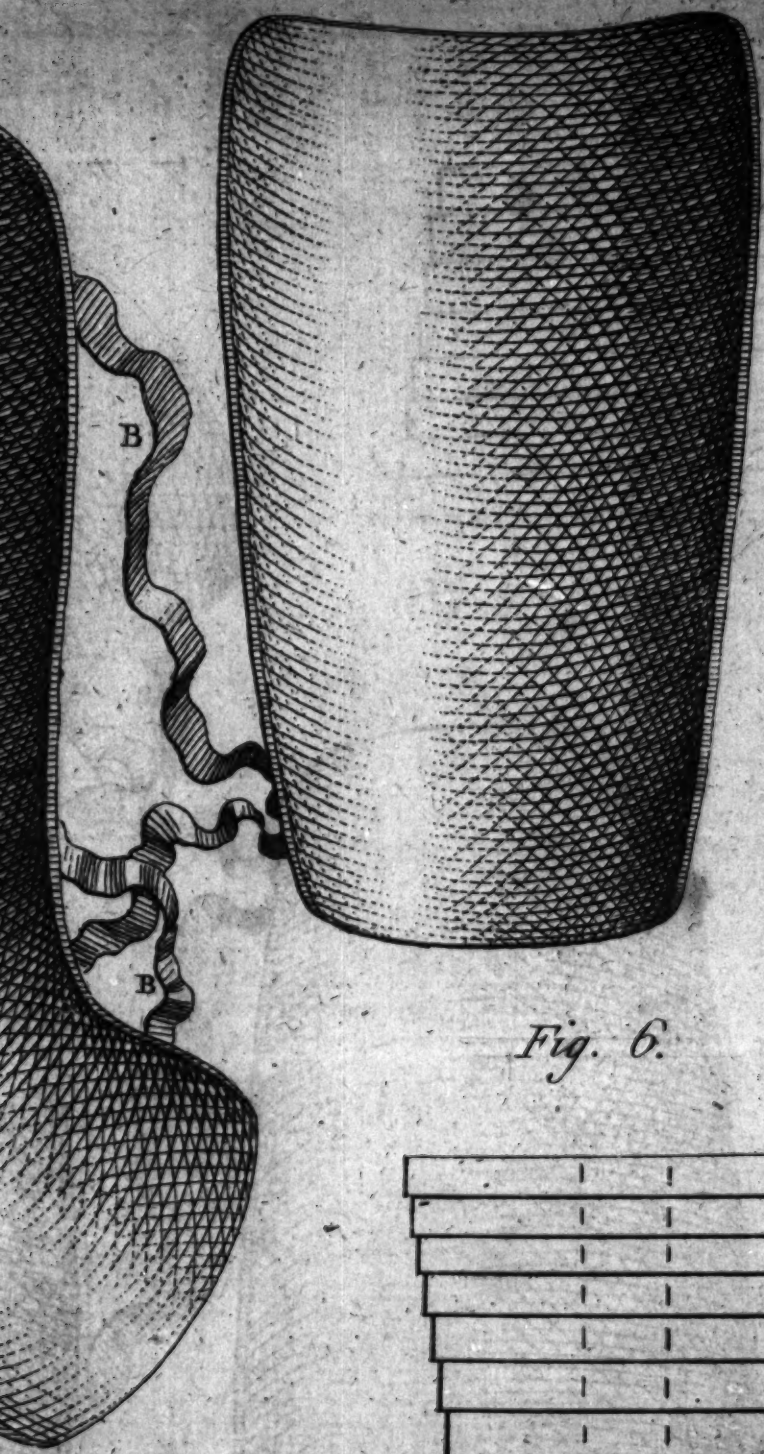


Fig. 6.

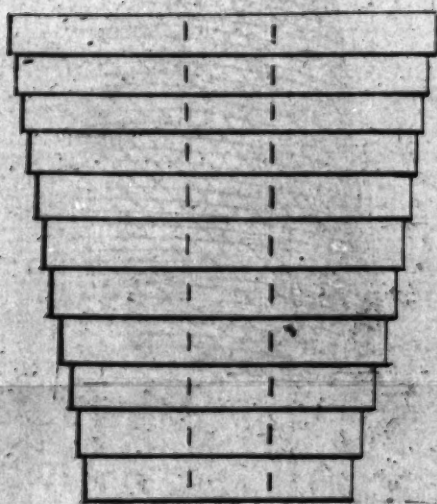


Fig. 4.

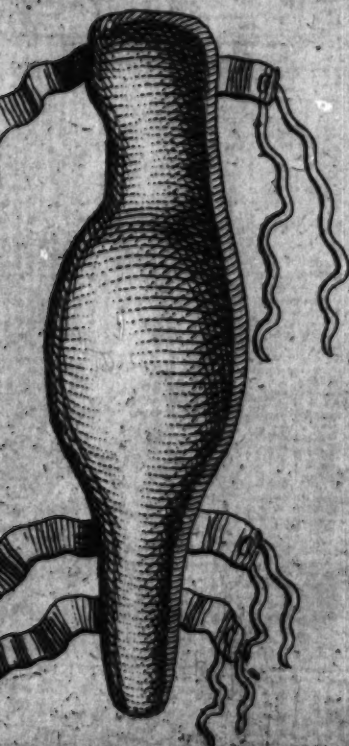
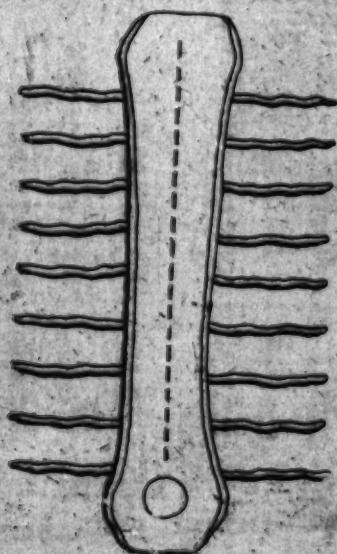


Fig. 5.



BB, strong tapes which are passed through flat loops on the convex side, to be tied over.

FIG. 2. the splint for the inside. This, lined and covered like the other end, when properly adapted to the two, ought to embrace the thigh completely, or nearly so. If this inside splint is made with a flexure at the lower end, like the other, the retentive effect is thereby encreased.

FIG. 3. exhibits a view of the machine of Mr Gooch's for the fractured thigh: its mechanism will be understood from what has been premised.

FIG. 4. gives a representation of the machine of Hildanus for the fractured thigh, formerly adverted to.

FIG. 5. shows the appearance of a pasteboard splint for the fractured leg, covered with the lining, which ought to be of doubled flannel, stitched to it, and straps also fixed to the outside, to be tied over the opposite one. The number of them may be various.

FIG. 6.

FIG. 6. is a delineation of Mr Sharp's bandage for fractures of the leg or arm, especially when compound, intended to supersede those commonly called Eighteen, &c. tail'd bandages.

EXPLANATION OF THE THIRD PLATE.

FIG. 1. exhibits a tin or copper splint, properly excavated to receive the outer part of the right leg, from above the knee downward, with its straps passed through flat loops on the convex part. There is a hole which is supposed to correspond to the wound of the compound fracture, which may be varied as to form, &c. as has been remarked.

FIG. 2. is a view of the sort of splint much recommended by Mr Gooch, formed of slips of thin wood glued upon leather. This splint may be applied accurately to a cylindrical surface; but no part of our limbs has this form; therefore its use is much limited, and indeed superseded by the other.

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Fig. 1

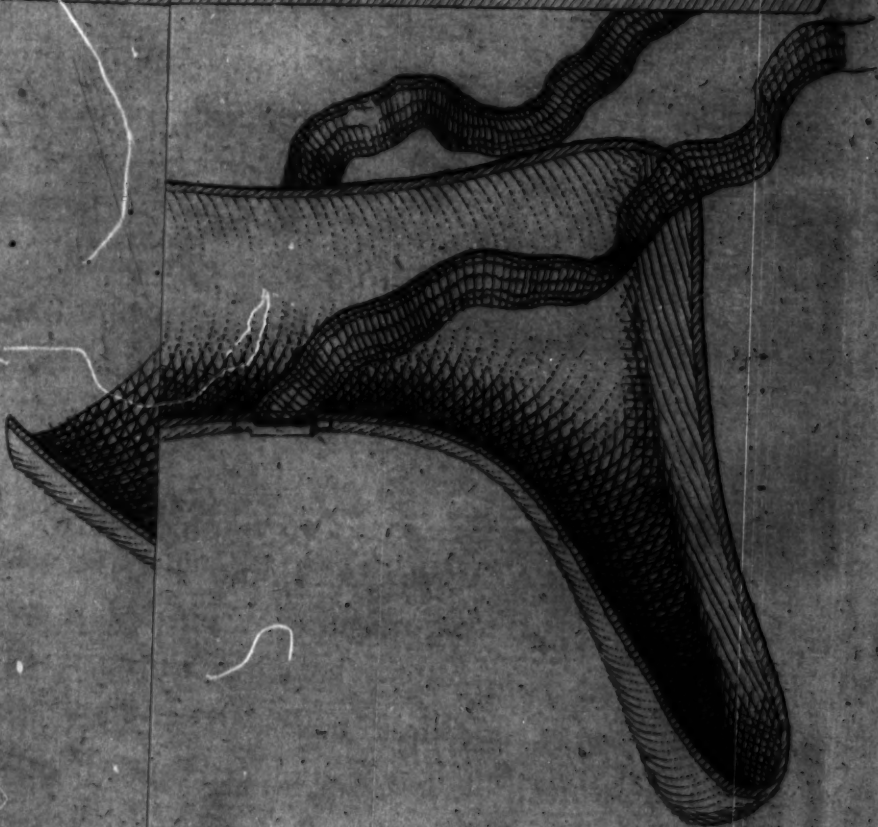
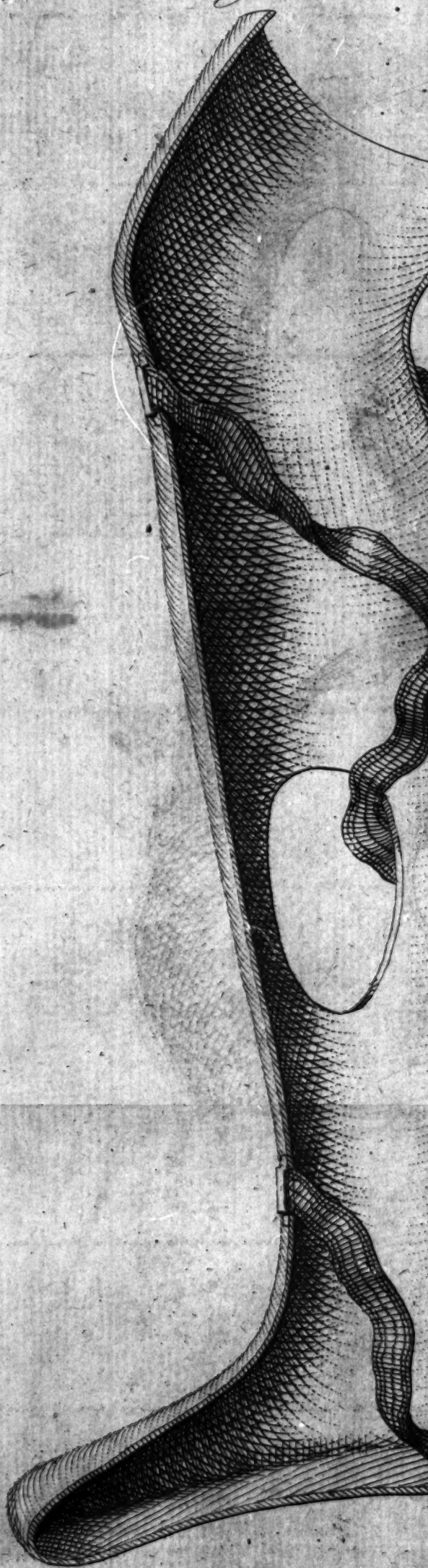


Fig. 1.



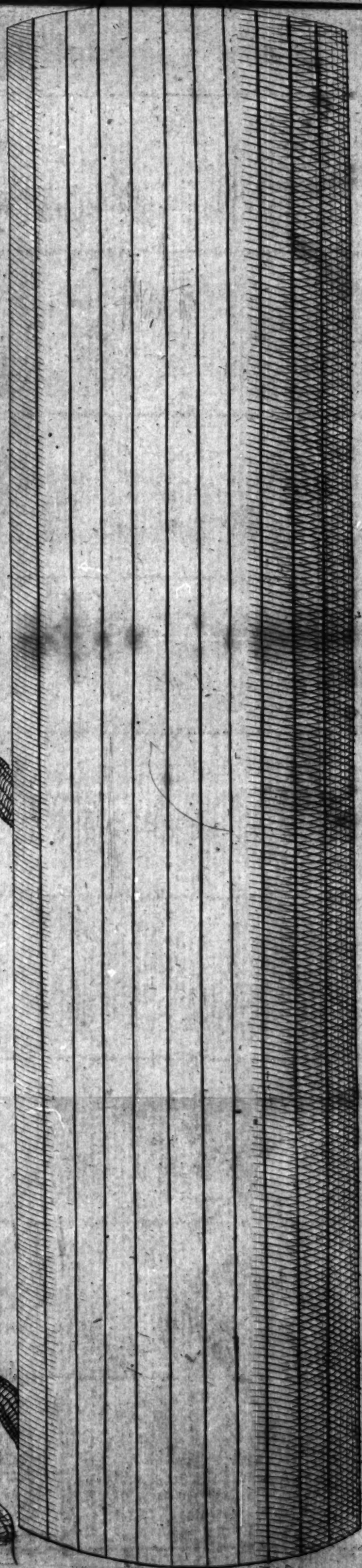
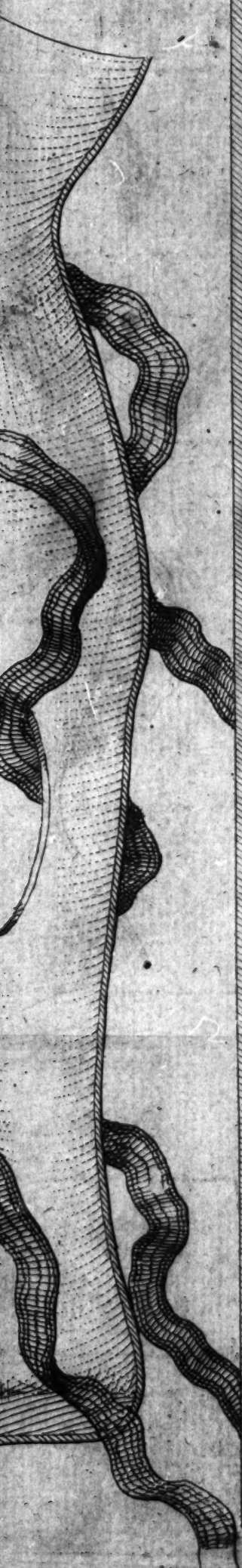


Fig. 1.

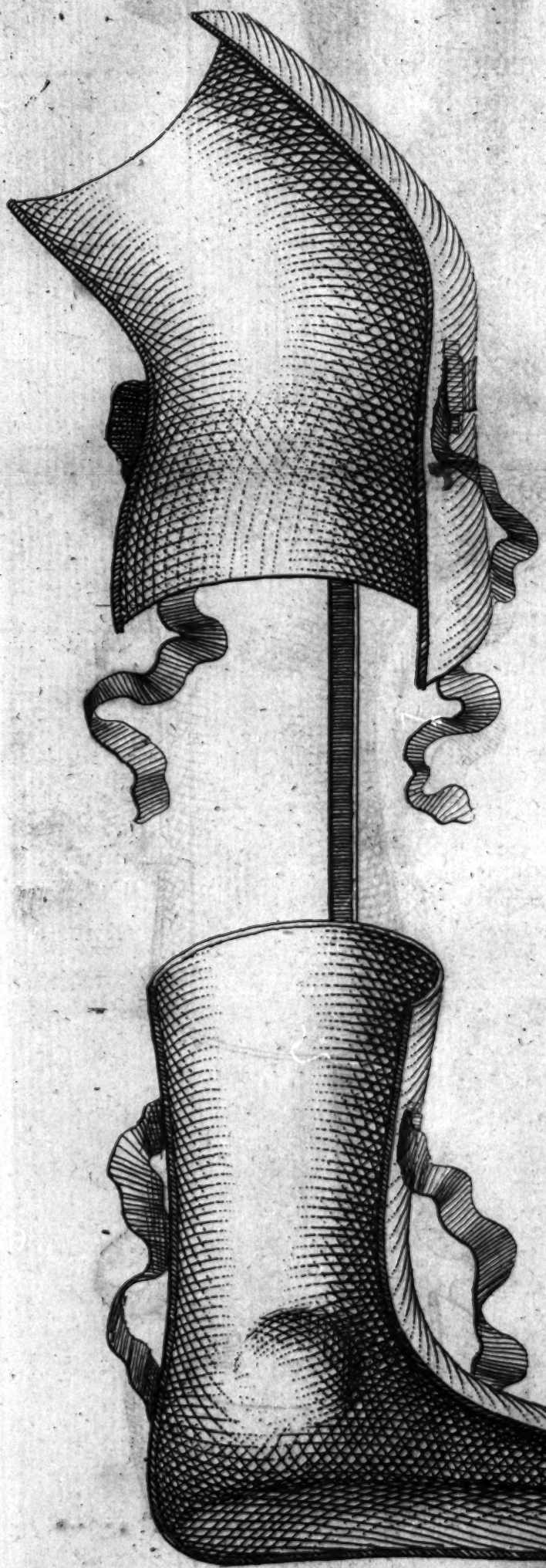


Fig. 2.

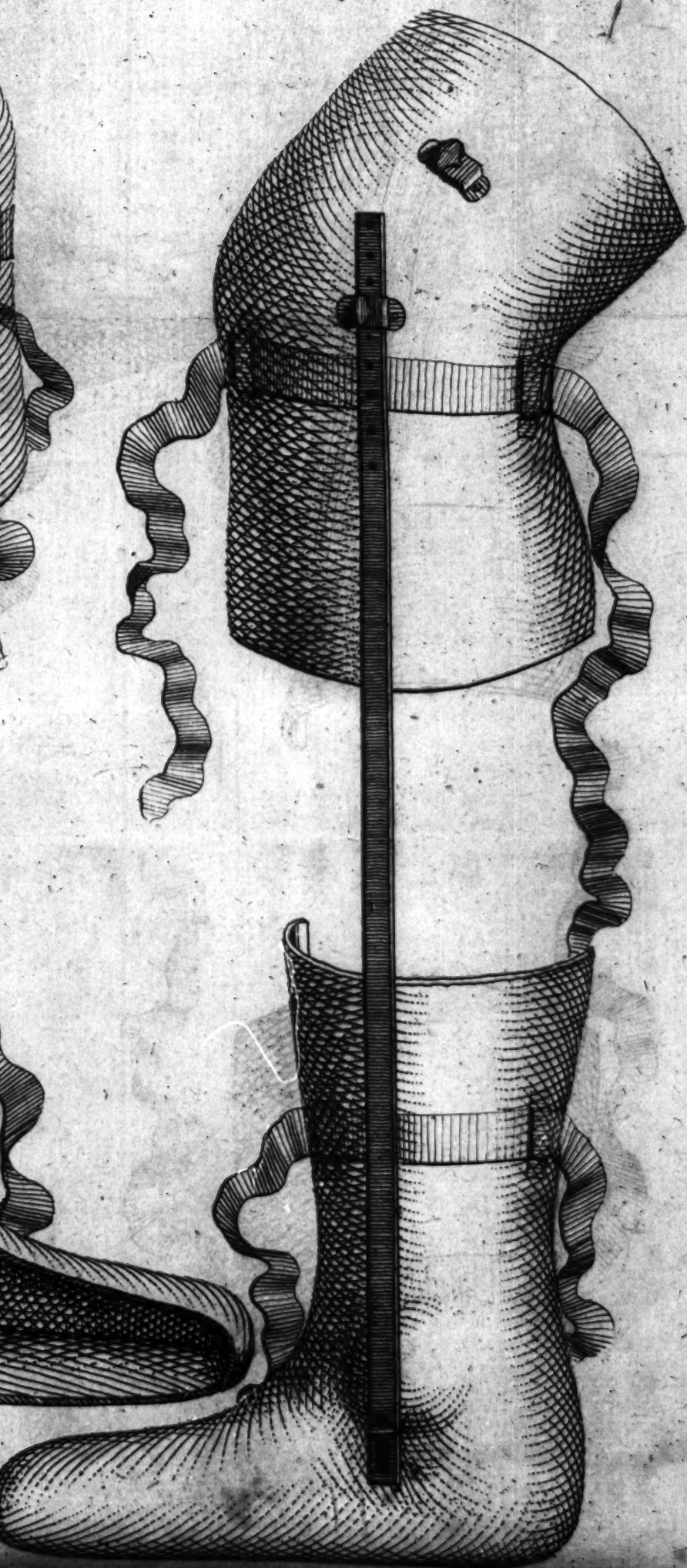


Fig. 1.

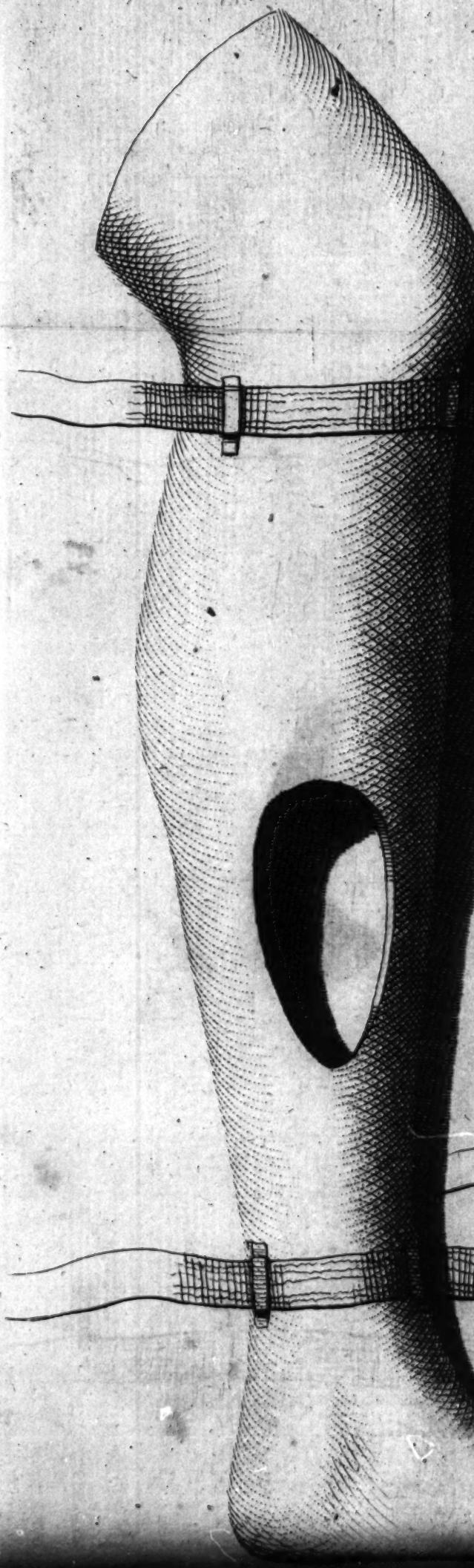


Fig. 2.

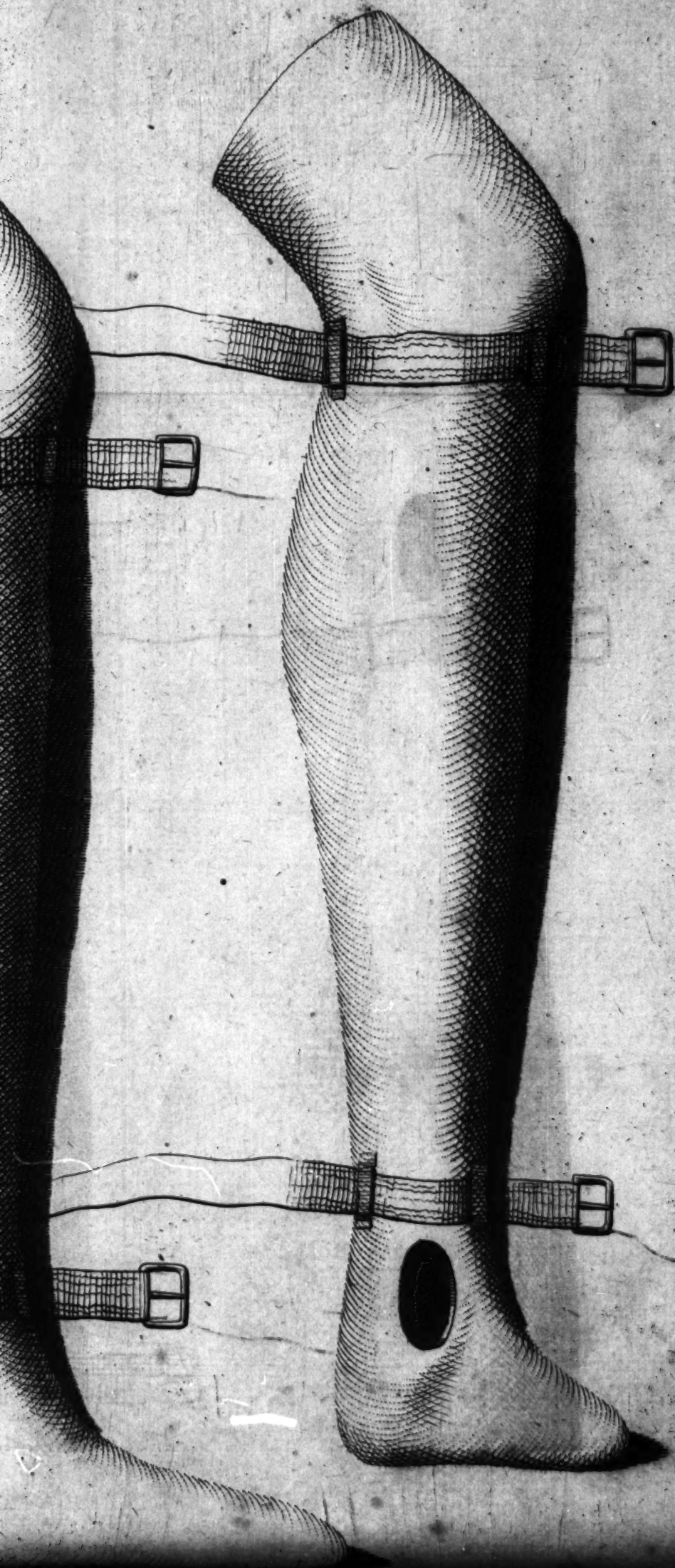


Fig. 2.

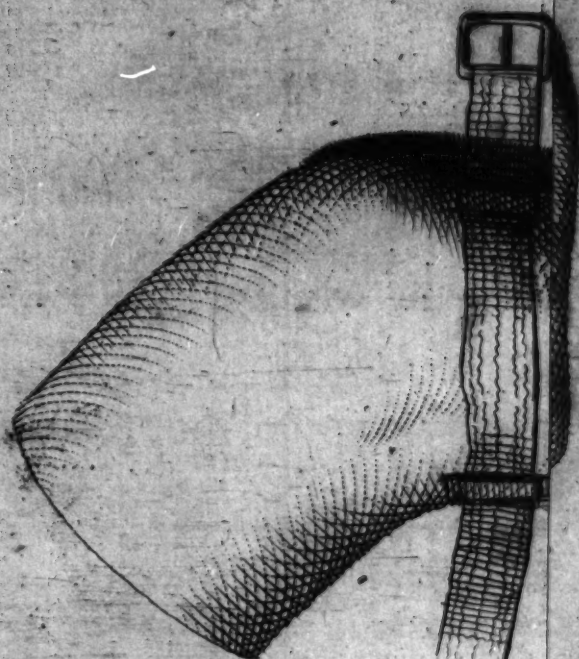
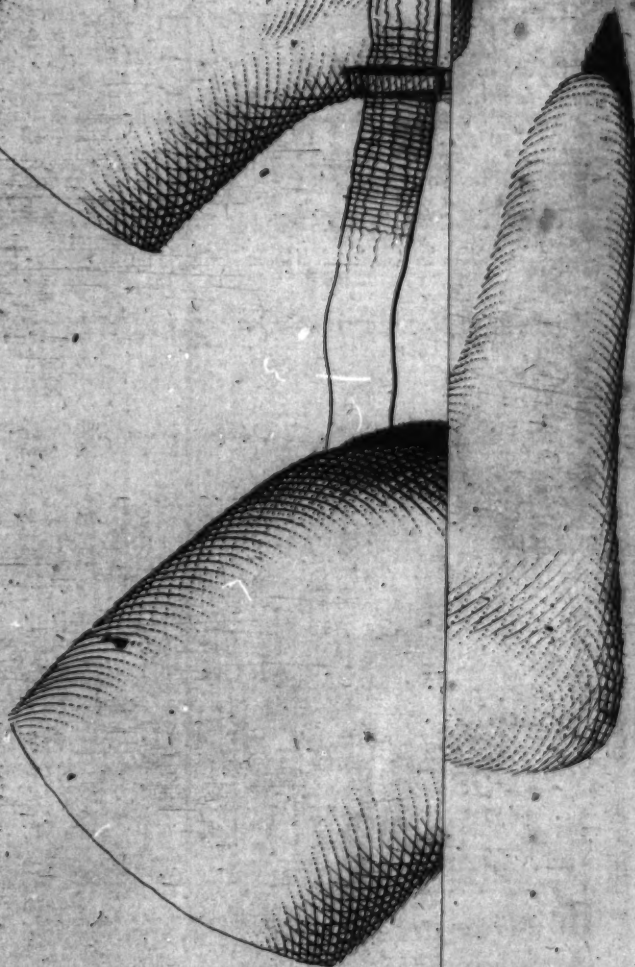


Fig. 1.



EXPLANATION OF THE FOURTH PLATE.

FIG. 1. is a delineation of the splint represented in Plate III. fig. 1. divided transversely with its concave surface seen: it is lined and accommodated with a graduated splint, by which it is capable of suiting legs considerably different in size.

FIG. 2. is a view of the convex side of the same splint, to explain the manner in which the splint is fixed to the two pieces, so as to produce the effect mentioned.

EXPLANATION OF THE FIFTH PLATE.

FIG. 1. exhibits a view of the convexity of a tin or copper splint, with a hole for allowing the discharge of the matter from the compound fracture, and capable to include the corresponding

M

side

side of the foot entirely. It is supposed to be provided with two leather-belts, with buckles, passed through flat loops.

FIG. 2. shews one with a hole for accommodating the ankle, and the foot-part of it less extended than that exhibited in the preceding figure.

OF FRACTURES.

OF FRACTURE OF THE TENDO ACHILLIS.

THE Tendo Achillis is often fractured, by violent efforts of the extensor-muscles of the foot, in dancing, jumping, &c. or divided with cutting instruments. The former case is analogous to simple, the other to compound fracture of the bones.

Although there is no external wound, the fracture, or, more strictly speaking, the wound of the tendon, discovers itself immediately, by the consequent inability of supporting the body on the affected leg with any degree of firmness.

In both cases, retention, or the perfect chirurgic cure, depends entirely on maintaining the foot in

an extended posture, so as that the parts of the divided tendon may be kept in exact opposition, and contiguous, (in the same manner as the fragments of the bones), till they are re-united.

The same method of cure is to be prosecuted for partial divisions of this tendon, and for deep transverse wounds of the gnostrocnemius muscle, whether immediately at or near where they become tendinous.

Various methods of maintaining the extended posture of the foot, to produce the desired retention, have been recommended by authors. Mr Gooch advises the following one :

“ The ends of the divided tendon are to be brought and kept as near together as possible, by a favourable posture of the limb ; which is effected by bending the knee and heel, and extending the foot to such a degree as is easy to the patient ; keeping it so, after dressing the wound, by the following bandage : First, equalising the small of the leg, with soft well-adapted compresses of
linen

linen cloth, fine tow, or quilting cotton, the latter of which is preferable to others.

“ Begin the bandage by making a few circular turns of a roller of a sufficient length and breadth about the thigh, just above the knee; passing it round below, two or three times, in a figure of 8; descending then in regular and small edgings, that it may be even and easy down to the ankle; making then a few turns, as about the knee, proceeding spirally to the toes; when, after making a few circulars, the roller is to be fastened with a needle and thread; reflecting it from thence upon the sole of the foot, up the back part of the leg, to the circulars above the knee; sewing it well there, and in the whole course of it, with a needle and thread; taking particular care, all the while, to have the leg kept in its true favourable posture, by assistants; and when this is done, it is necessary to have it rested upon a pillow in bed, strictly enjoining the patient's own care to keep the limb quiet. The application of this bandage may be begun upon the foot at the toes; leaving a portion of the roller then to be

be reflected, fixed, and secured, as above described."

Although there should be no attending wound, this method by the roller-bandage must be exceedingly troublesome and laborious, and I think imperfect; but where there is a wound, it must prove much more so: Besides, the extension of the foot cannot be graduated without undoing almost the whole roller.

The celebrated M. Petit invented the following method for effecting the retention in question, by which the extension can be regulated at pleasure.

A sandal or shoe, with a low quarter-heel, is put upon the foot; from its back-part a strong strap passes up the leg to the back-part or hollow of the ham, where a small axis in peritrochio is placed, and secured by means of a broad circular, so divided in its fore-part, that one half passes above and the other below the knee. By turning the axis, which is provided with a handle, the strap from the heel can be shortened or relaxed at pleasure, and consequently the foot proportionally

tionally extended. If there is a wound, nothing impedes the necessary dressing.

A method almost similar, though more simple, was practised by the late Professor Dr Monro. He made use of a foot-sock, or slipper of tiking, (Plate VI. fig. 1.), open at the toes, to prevent them from being squeezed, when the extension was made by a strap, which went from the back-part of the sock to fix above the calf, to a circular, or calf-piece, (fig. 2.), which surrounded the leg here, and laced before by means of pye-holes. The strap was graduated by the help of a buckle, (fig. 3.), in place of the axis in peritrochio of M. Petit. He wore this dressing for fifteen days, without moving the foot. To prevent too great extension of the foot, at the end of six weeks, when he was obliged to go abroad, he wore a shoe with a very high heel, (fig. 4.). For greater security still, for five months more, he had a piece of steel, (fig. 5.), that reached from the broad of the foot to the fore-part of the leg; at both ends, this steel-machine was flat and stuffed, to give as little uneasiness as possible: it was secured by ribbands.

A

A most complete cure was the reward of all this caution and ingenuity.

I tried this plan of retention in the case of a gentleman; but finding his leg shrunk considerably from the pressure of the calf-piece, I lengthened it, so as to make it extend half-way up the thigh; and finally, which is an obvious improvement of this apparatus, I substituted a pair of strong drawers, to the point of which, corresponding to the ham, the strap of the fandal and buckle were fixed like a boot to the breeches. I thus obtained a complete cure.

When the fore-splint of the leg-machine is removed, as is represented by the dotted lines Pl. I. fig. 4. the foot is very readily made to assume the extended situation; and as readily maintains that situation, if a straight splint is made to pass from the circular to the point of the shoe. By means of the screw-nail in the plate of the circular, it may be easily comprehended how accurately the quantity of the extension of the foot may be graduated; and,

and, when determined, maintained with the utmost steadiness.

Since treating the case already recited, I have devised a slight alteration in the splint recommended for retention of the fractured leg, that completely supercedes every contrivance hitherto proposed for that of the fractured tendon of Achillis.

The splints (Plate VII.) are so shaped at the ankle part, that they keep it unavoidably in the extended posture, and at the same time secure the knee in a state of semiflexion; by which the gastrocnemius muscle, which is attached to the os femoris, is kept relaxed: An advantage not to be derived from any of the plans of retention hitherto described.

This machine offers itself, therefore, as second to none, as far as I know, in simplicity, safety, security, and ease. By it the time of confinement may be much abridged; in a very short time, the patient may venture abroad with the greatest safety, in a carriage, on horseback, or with crutches: by it the toes are in no danger of be-

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ing

ing squeezed or crushed. Wounds attending fractures or partial divisions of this tendon, or wounds of its muscles near its commencement, can be dressed with the greatest freedom.

EXPLANATION OF THE SIXTH PLATE.

THIS Plate exhibits the apparatus partly invented and employed by the late Professor Dr. Monro, in his own case, of which a full account is given in *Essays and Observations, Physical and Literary*.

FIG. 1. represents the tiking sandal open at the toe-part, and with a strap from its heel-part, to be buckled to

FIG. 2. the calf-piece, which is fixed by a lace above the calf, so that the buckle falls directly behind, to correspond with the strap of the sandal.

FIG. 3. exhibits a leg, with the foot duly extended



Fig. 1.

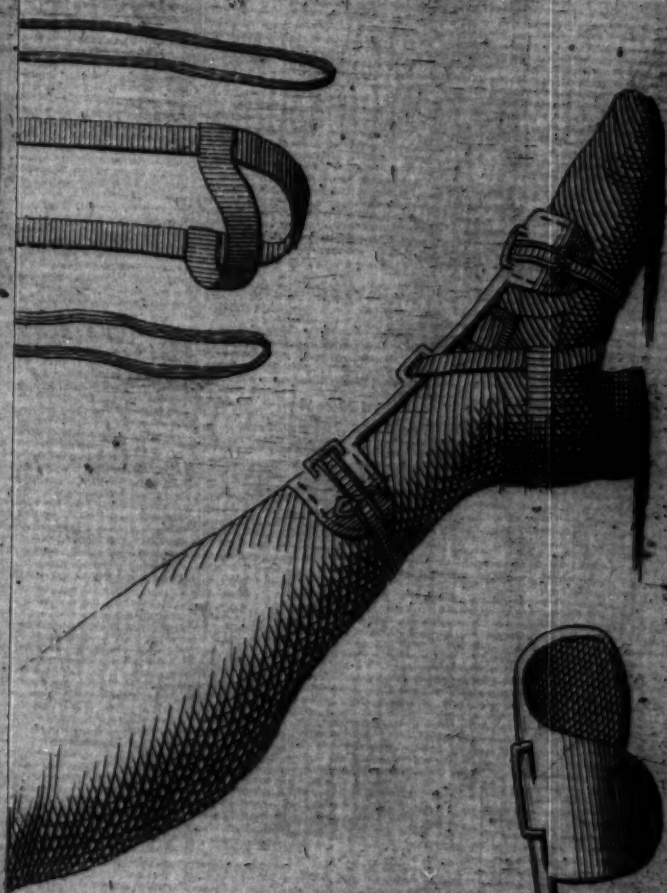


Fig. 5.

Fig. 1.



Fig. 3.

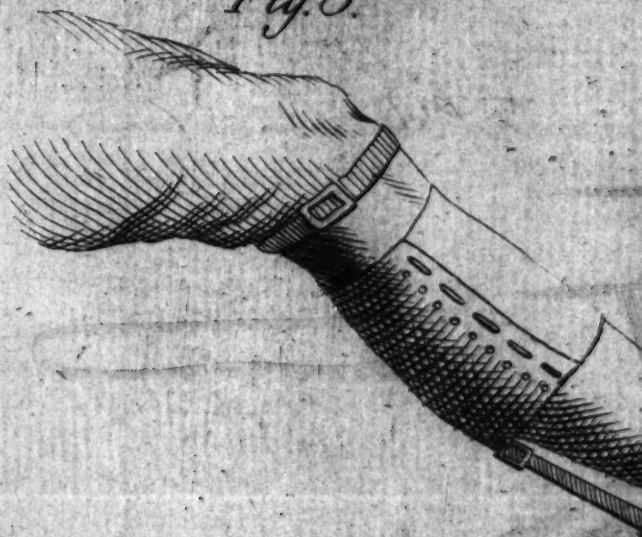
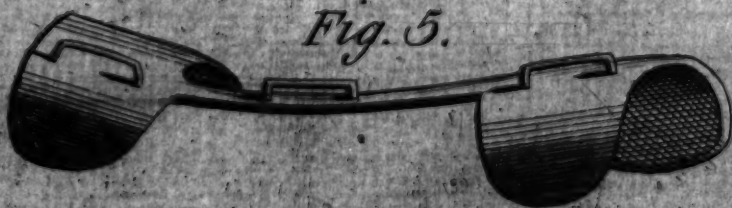


Fig. 4.



Fig. 5.



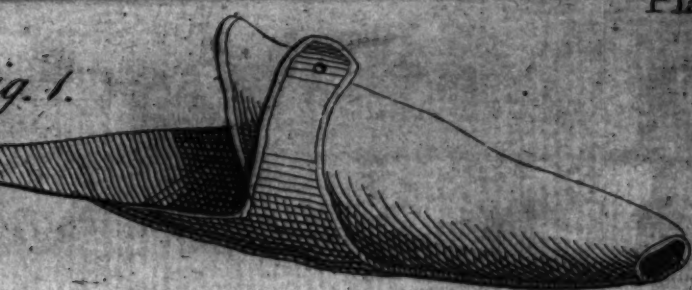


Fig. 2.

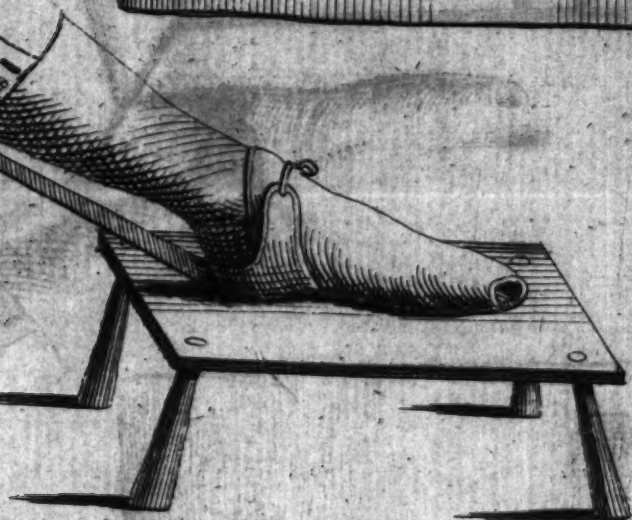
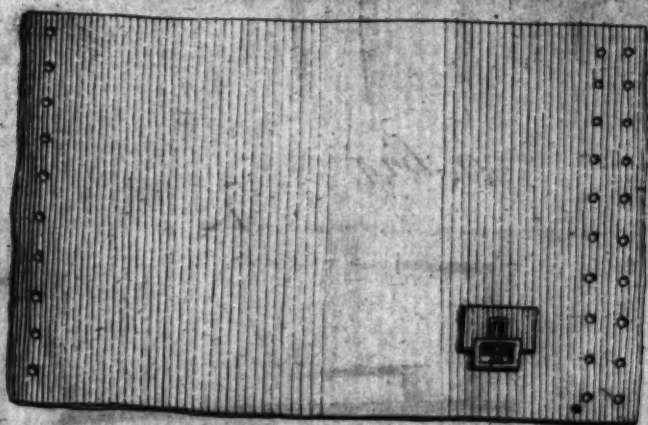


Fig. 6.

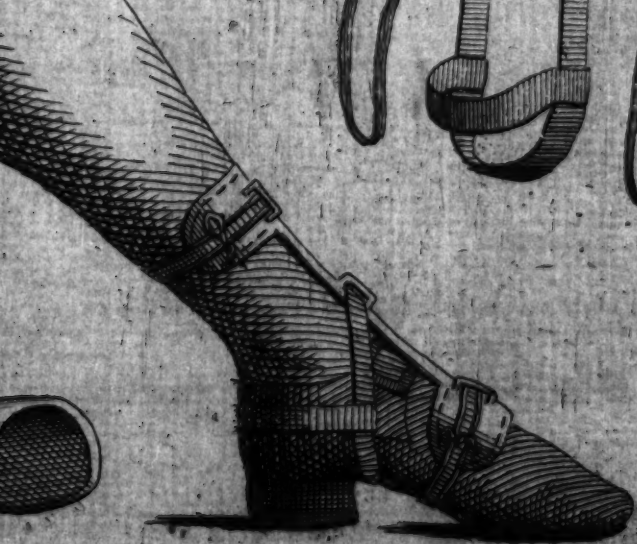
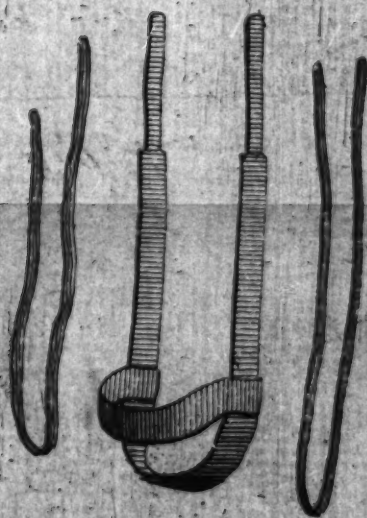
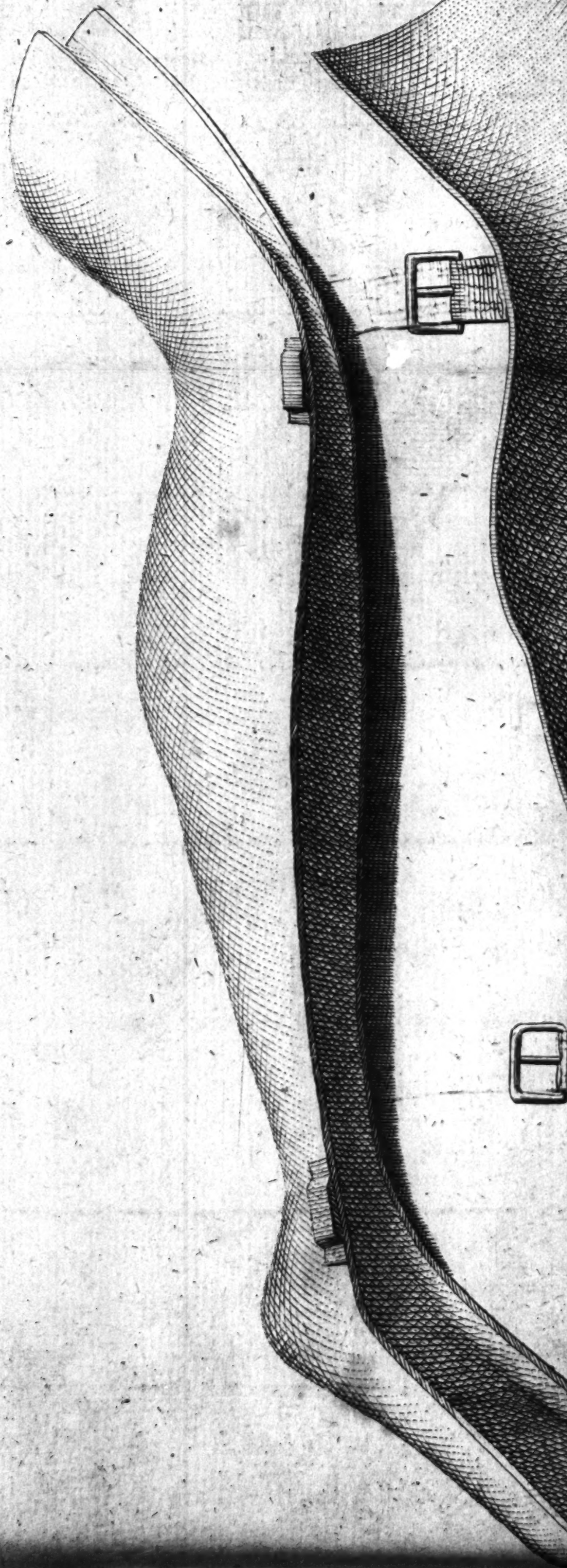


Fig. 2.

Fig. 1.



g. 2.



Fig. 2.

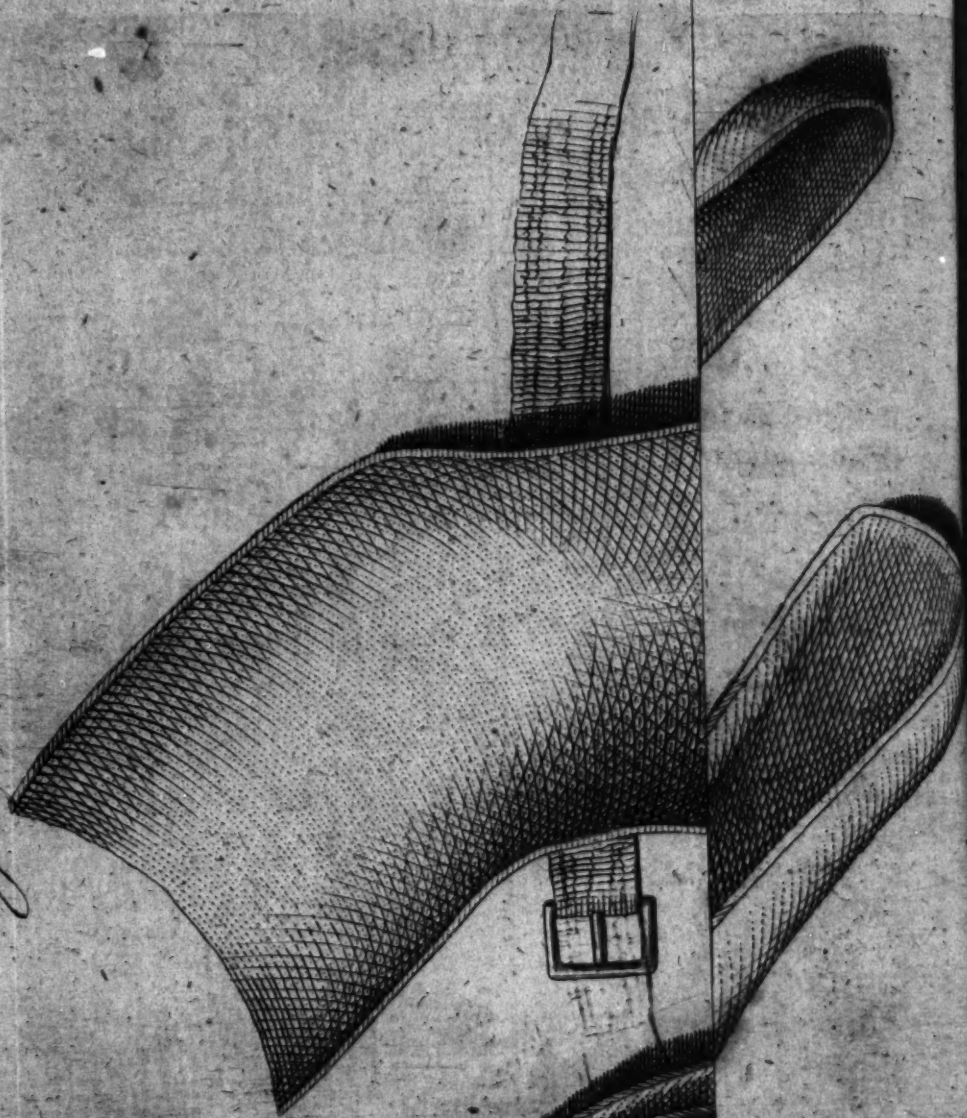
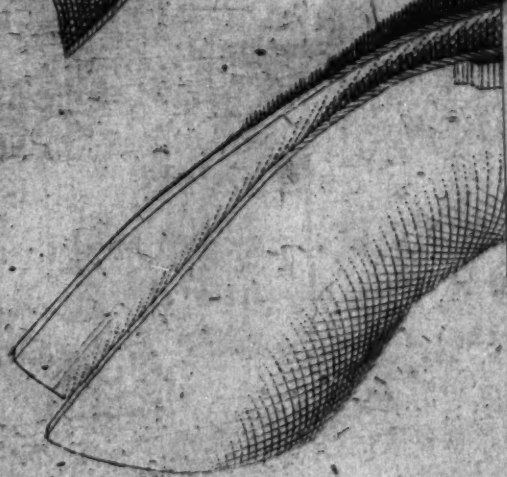


Fig. 1.



OF FRACTURES.

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tended, and resting on a stool, to which the sandal and calf-piece are applied, and the manner of their connection by the strap and buckle shewn.

FIG. 4. is a delineation of a leg, in the same position as that of FIG. 3. but with a high-heeled shoe instead of the sandal, and with the splint,

FIG. 5. reaching from the fore-part of the leg to the upper part of the foot, properly secured by the straps,

FIG. 6. so that no motion at the ankle is permitted.

EXPLANATION OF THE SEVENTH PLATE.

THIS gives a view of the splints adapted to the leg, with the broken tendon of Achillis.

FIG. 1. exhibits one of them, so formed that it may be applied to the back-part of the leg; and it is supposed that a corresponding one is fitted

to its fore-part, so as completely to invest the leg; they are then secured immoveably by the straps and buckles shewn in

FIG. 2. which gives a view of another splint for this purpose, so shaped that it applies to the leg laterally; by this, and a corresponding one, the leg is wholly inclosed; and when the straps are properly buckled or tied, they absolutely prevent any motion of the knee or ankle; which is a circumstance of great effect, as explained above.

OF the FRACTURED PATELLA.

THE patella, rotula, or knee-pan, is sometimes, though very unaccountably, fractured in a longitudinal direction with respect to the leg. This bone, however, for very evident reasons, is most frequently fractured in a transverse direction.

The cure of the transverse fracture of this bone is rendered very difficult by its flat roundish form, by the neighbourhood of the knee, but especially by the contraction of the very strong extensor-muscles of the leg, which are attached to its upper edge. Sometimes it is so unequally divided, that only a very small fragment adheres to the tendons of these extensor-muscles: A circumstance

stance which adds very considerably to the difficulty of retention.

Like all other fractures, the cure here is to be attempted by approximating and keeping contiguous the fragments of the bone; to effect this, the extended posture of the leg with respect to the thigh, and the bended posture of this with respect to the trunk of the body, are absolutely requisite.

It very seldom happens, that the fragments of the patella are firmly united by callus: on the contrary, they are fixed to one another by a ligamentous, or, at any rate, a flexible substance, of various length. I saw an instance of this kind at the Hague, in the collection of the late respectable Dr Camper. The person to whom it belonged, during the cure of the fracture, was attended by the Doctor, and at his death ordered that it should be delivered to him.

This circumstance unquestionably results from a defective retention, and is not productive of any advantage. I therefore conclude, that the less intermediate substance, the better the cure.

M.

M. Petit, to effect retention of the fragments of the patella, prescribes as many compresses of various shapes, and as many bandages and rollers, of different lengths and breadths, as would require a great measure of patience properly to apply. The retentive powers of all soft pliant bandages, however dexterously they may be adapted, are here feeble, and for the most part inadequate; and when employed during the whole process of the cure, (which I have known eight weeks insufficient to obtain), the patient must be confined to bed; at least the affected limb must be moved with the greatest caution.

It will be evident how perfectly the retention of transverse fractures of this bone may be accomplished, by the circular of the leg-machine, and the inferior one of the thigh-machine, connected laterally together by the jointed graduating splints, Plate I. Fig. 3. The back edges of these splints are to be turned forward, to prevent all flexion of the knee-joint: proper compresses of folded linen are also to be interposed betwixt the circulars and knee-pan, especially betwixt it and the upper one. The graduated connecting splints
allow

allow the circulars to be more or less approximated, as may be necessary.

The like effect may be produced by the knee-pieces of the leg-machine, represented in Plate IV. properly applied and secured in just opposition. This apparatus keeps the joint in a gentle flexion, which some think to be an advantage; but it may be made so as to keep it quite extended, which is the preferable position.

It will be observed, that as all motion of the knee-joint, by this mode of retaining the fractured patella, becomes impossible, the necessity of confining the patient to bed for any length of time is superseded: on the contrary, he may move about with a good deal of safety after a few days. The circulars require to be applied with much less strictness than the roller-bandages commonly employed.

The first Figure of the eighth Plate represents a leather-bandage for approximating the fragments of the patella; but it will be immediately

ly perceived, that the assistance of the machines already described is wanted.

The method of cure here proposed for fractures of the patella, will answer equally well, if at any time the ligament connecting it with the tibia is ruptured.

OF THE FRACTURED CLAVICLE.

THE Clavicle partakes a good deal of the form and position of the ribs. It is placed almost horizontally between the acromion scapulæ and the corresponding angle of the top of the sternum, and consequently is the sole connection between the bones of the superior extremity and the rest of the skeleton. It is in fact the fulcrum on which this extremity is supported during many of its motions, while it prevents the shoulder from approaching too near to the sternum.

All the circumstances of the Clavicle duly considered,

sidered, it will be perceived, that it is necessarily, on many occasions, subjected to great strain in the most unfavourable manner. It is not therefore surprising that it should be fractured generally about the middle part that arches a little forward.

As the Clavicle is comparatively placed superficially, its condition can be easily examined and ascertained; and consequently fracture of it readily detected. In general, the one fragment rises a little over the other, and produces a small tumour.

This fracture is often, and without much inconvenience, left to the natural cure: however, it is obvious, that the chirurgic cure ought not to be neglected; especially in the female patient, to whom the exact preservation of the natural form may be deemed a matter of importance.

The retention is easily effected, by draw-

ing the shoulder connected with the fractured Clavicle duly backward; and then pressing the displaced fragments gently into their situation.

It is more difficult, on many accounts, to obtain due retention, particularly the small surface of the fragments in contact, and the almost unavoidable motion of the arm.

The best method I know, and I have often experienced its good effect, is, to apply a long roller, in the form of the figure of 8, behind, between the shoulders, so as to approximate the bases of the scapulæ more than usual to one another. By this means the requisite degree of extension is produced and supported. Full retention is then obtained, by placing compresses over the place of the fracture, so as to equalize it, that it may receive the retentive pressure of the spica scapularis, so applied as entirely to cover the seat of the disease.

To

OF FRACTURES

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To be successful, these rollers should be long, made of flannel, and about three inches in breadth. It is unnecessary to remove them for three or four weeks.

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OF

The successful man should be one
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OF LUXATIONS.

DEFINITION.

LUXATION and Dislocation are terms used by Surgeons to express the loss of situation of the extremity of a bone or bones concerned in the structure of a joint possessing motion, with various injury of the adjoining parts. When this is not complete, it is called a Subluxation, which seldom occurs.

Although the following observations chiefly refer to Luxation of the bones of the extremities; yet, as far as they are founded on general principles, they must be applicable to every variety of the disease.

OF THE CAUSES.

A Bone is liable to be luxated in proportion to the quantity of motion of the joint of which it forms a part; or, in other words, the more extensive the motion of a joint, the more susceptible is it of luxation from a given cause. Accordingly we observe, that the shoulder-joint is most frequently the seat of the disease in question.

It is understood, that we are treating of idiopathic luxation, of which external violence, viz. strokes, falls, &c. often assisted by the luxated bone as a lever, is the occasional cause; for when this disease flows from internal causes, gradually altering the ligaments, and other component parts of a joint, it is symptomatic, and does not receive the chirurgic cure hereafter described,

bed, till the primary be subverted, as was remarked with regard to symptomatic fracture.

It is obvious, that in this, as in every disease, the occasional cause must operate in various degree, according to circumstances, to produce its full effect. Indeed sometimes it is so excessive as to injure the adjoining parts so extensively, that the affection may, in allusion to fracture, be named compound Luxation. Thus, I have seen the extremities of the bones of the fore-arm protruded by the luxating violence through the soft parts of the wrist-joint above the palm.

When a low degree of a luxating power has acted, subluxation is the consequence.

OF THE SYMPTOMS.

THE symptoms which mark a luxation have a great affinity to those of fracture.

P.

1. Pain

1. Pain variously intense, especially when the joint is disturbed. This perhaps flows in some degree from the laceration of the capsular ligaments, which happens always proportionally, but principally from the derangement of the attached muscles, which are sometimes much violated, and from the pressure of the luxated bone against the nerves and vessels.

2. Loss of the usual form or appearance of the suspected joint. This, being various in degree, must be variously conspicuous. The cause is easily assigned. It was formerly remarked, that the general figure of our body depends greatly on the bones, and their due arrangement. When, therefore, a bone is luxated, an alteration of the external form of the joint in which it is concerned is a necessary consequence; especially as the displaced bone is by the muscles generally drawn unduly upward, and thus the limb more or less shortened.

3. Diminished motion. This is an unavoidable effect

OF LUXATIONS.

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effect of luxation, and always exists more or less.

4. Swelling occupying the circumference of the joint in which the luxation has taken place. It was formerly observed, that there seemed to be a fixed connection between certain degrees of pain and swelling. This partly, then, accounts for the symptom in question; which is sometimes so considerable, and accedes so suddenly, as to obscure the others. The greater degrees of tumefaction partake of the nature of ecchymosis, being caused by blood effused from luxated vessels. Much depends on the mode of the occasional cause.

The pain and swelling are only present in the recent luxation; for by degrees the irritation on which they depend ceases.

OF THE DIAGNOSIS.

THE enumerated symptoms will in general be sufficient to furnish a diagnosis. Indeed there are few affections with which there is any risk of confounding this in question. Fracture near a joint, and contusion accompanied with much swelling, may sometimes occasion perplexity; but a full investigation, joined with anatomical information, which is indispensable, will soon dispel it. Professional character is here easily lost.

OF THE PROGNOSIS.

IT may be affirmed from experience, that luxation in general is not dangerous: on the contrary, it is very curable. In the young subject, and
in

in a recent affection, a cure may be expected more readily than in opposite circumstances. Indeed, in every case, I am much disposed to believe a cure is obtainable; and that therefore failure is to be stated against the Surgeon.

OF THE CURE.

LIKE that of fracture, the cure of Luxation is both natural and artificial.

Nature, or the healing power, makes no effort to replace the luxated bone. This can only be effected by art or Surgery, and is the artificial or chirurgic part of the cure. But nature accommodates, as it were, the bone in its new situation, as much as possible. In some instances, a new socket is provided for it; and in every case a concretion is formed betwixt its torn ligaments and the cellular substance with which they may have come into contact; and in like manner, after the bone has been restored to its place, this healing

ing power must restore the ligaments and injured parts to soundness, which happens with various expedition, according to the degree of violation they had sustained.

It will appear from what is premised, that the chirurgic cure is indispensable. It requires

1. Extension, and

2. Retention.

OF EXTENSION.

EXTENSION is necessary to draw down the luxated bone to its proper situation; for it is constantly moved upwards by the muscles, whose action is much increased by the irritation to which they are now subjected.

As the muscles constitute almost the whole resistance to be overcome by extension, it is reasonable previously to relax these as much as possible,

as was observed when treating of fractures. This is principally done by semiflexion of the leg or arm at the knee or elbow.

As in the case of fracture, the drawing must only be applied to the affected bone; for applying it to a more distant one is incompatible with the relaxed disposition of the muscles already mentioned, and hurtfully subjects the intermediate joint or joints to unnecessary racking.

The extension ought at first to be attempted, especially when the patient is young, by the Surgeon alone; for in Surgery, I consider it to be a fixed maxim, That in every operation the Surgeon is not to be indebted to another for performing what he conveniently might have done himself; and that he is not to recur to the mechanical powers or machinery for that exertion which may be furnished by himself and assistants.

From a low and gentle degree of extension, in a just direction, the Surgeon must gradually proceed to greater and greater, according to the resistance, till the luxated bone be retracted to what may be called the level of its socket, which
by

by the muscular action it then suddenly re-occupies, and generally in doing so gives an audible stroke against it.

OF RETENTION.

RETENTION, it will be understood, may be trusted to the muscular action, which presses the reduced bone firmly into its place; but where the parts have been much violated, it may be necessary to apply a proper bandage, and to put the limb in the relaxed posture, or, in other words, to recur to suitable dilitation and posture till they be confirmed.

I have scarcely in any instance found it necessary to attend much to retention.

HAVING thus premised the general doctrine, it may be proper to advert somewhat to the more interesting particular luxations.

OF LUXATION IN THE SHOULDER-JOINT.

WHEN the superior extremity of the os humeri, or arm-bone, is driven from its socket, or the glenoid cavity of the scapula, or shoulder-blade, luxation is said to exist in the shoulder-joint; and, for reasons assigned above, this is by far the most frequent.

The acromion process of the shoulder-blade is so placed, and connected with the corresponding extremity of the clavicle, that the dislocated head of the arm-bone is prevented from moving upward or backward: it is therefore determined to slip forward and downward till it is disengaged from its socket; and then is retracted upwards:

so that it is always, or almost always, lodged in the upper part of the arm-pit, above the margin of its socket, or somewhat forward, under the edge of the great pectoral muscle, where it can in general be easily felt, especially if the arm be made to roll a little about its axis. As the deltoid muscle is now unsupported by the round extremity of the arm-bone, it becomes comparatively flat, or, in other words, the shoulder loses its natural rotundity and form; which affords the well-informed Surgeon a very certain diagnostic.

While the dislocated arm-bone is situated as described, it is evident, that the short muscles inserted near its head must be greatly deranged, particularly the supra-spinatus and the infra-spinatus must be much stretched. Indeed in some cases I have suspected a laceration. These circumstances sufficiently account for the pain, independently of the pressure and disturbance to which the axillary nerves and vessels may be subjected from the end of the arm-bone in its new situation.

It may be proper to recount the most probable
and

and efficient modes of extension that have been proposed, or that may be practised; and then, by comparing them, make a selection suited to the particular circumstances of any occurring case.

f. The patient may be placed in a chair of proper height; the Surgeon lays firm hold of the arm above the elbow with one hand, the other he applies to the shoulder, near the joint, so as to counteract, while he attempts to extend; or he may attempt, with the hand applied to the arm, to elevate the patient somewhat, and with the fingers of the other, pressed under the head of the luxated bone, which is generally easily felt in the arm-pit, attempt to raise it to the level of the socket.

This method I have sometimes tried successfully; but it will be understood, that it is only suited to young and slender subjects; and even in these to recent cases; because, in other circumstances, the Surgeon's strength, which is the only

extending power, is likely to be inadequate to the resistance.

2. The patient may be laid on the chamber-floor, spread with carpet or blanket; the Surgeon then sits down by him, so that he may be able to apply his heel, or rather sole, to the patient's side, near the axilla, corresponding to the luxated bone; then he grasps firmly the arm above the elbow, and attempts the necessary extension, counteracting properly with his heel: instead of applying his hand to the naked arm, he may, if necessary, employ lacs hereafter described.

Thus, drawing by the arm is clearly preferable to the ordinary method of doing it by the hand; because we obtain the advantage of the relaxed state of the muscles, and avoid racking the elbow and wrist joints.

I have never tried this method. Performed as described, it may enable the Surgeon to reduce without assistants, in cases of luxation, that otherwise

therwise would require other means equally powerful.

3. The patient is to be placed on a strong chair, (indeed in Hospitals one particularly strong and properly sized should be made on purpose), with its back so high, that, when properly covered with a pillow or blanket, it may reach to his axilla when he is seated side-ways, as is represented in Plate IX. Above the elbow, a lac of a proper form is to be applied; without which a sufficient number of assistants could not seize the arm in its relaxed state, and act in concert.

A great deal of the chance of succeeding depends on the lac. A common towel surrounding the arm twice immediately above the elbow, and then knotted once, and the assistants drawing by the projecting ends, is a very exceptionable one; for in proportion to the drawing is the running stricture; so that it soon becomes intolerable. Therefore, if we are to use the towel at all, we must knot it for good, and introduce straps or cords of sufficient strength, betwixt it and the surface of the arm, and order the assistants to draw by them; by
this

this means, what I have called the running fracture is avoided.

In the second figure of the eighth Plate, a lac is represented, which will answer well when excessive drawing is not wanted. Its size and shape are adapted to the surface of the arm immediately above the elbow, while in the bent position, for which suitable notch in the inner part of its inferior margin. It is stuffed and lined, to diminish the pressure when it is firmly fixed by belts and corresponding buckles, so as to grasp securely the os humeri above the condyles, so as not to slip down during the drawing; which is effected by cords looped on the strong hooks, securely fixed at proper distances, on the external surface; so that one rests on the external, the other on the internal part of the arm, above the joint.

I have repeatedly employed this with due effect; in some cases, however, where a great extending force was necessary, I have found it unable to keep its situation, which either retards or defeats the process. This circumstance suggested the one represented

presented, applied properly to the arm, in Plate IX.

This lac consists of two strong and long straps of girthing, placed longitudinally on the external and internal naked surface of the arm, above the elbow. They are then secured by a piece of the same stuff, surrounding the arm by repeated serpentine turns, very firm, by the ends of the longitudinal straps, tied respectively, to allow the assistants a very sufficient hold, while the firmness of the circular one prevents them from slipping below the condyles and elbow, as happens sometimes when the last described one is used, as has been remarked. This applies with equal effect to the thigh, as will be afterwards noticed. In a word, it is the simplest and best lac I know.

The lac and straps being adjusted, two or more assistants draw by the latter, at first gently, and always steadily, in various direction, as represented by the pricked lines in the figure last quoted; while the Surgeon stands behind the affected shoulder, to observe the changes, and to give the necessary directions to the assistants; while the chair

chair is rendered immoveable by a strong belt or rope, as expressed in Plate IX, connected to a post or some fixed point. I have never failed in any attempts to reduce when this plan has been duly executed.

3. Instead of assistants, the Surgeon may employ what I call the foot-lever, as represented in the Plate above cited. The straps connected with the lever, and the foot applied to the end of it may produce a great exertion, either by a steady pressure, or in the style of a jerk; which last is excellently calculated to destroy obstinate concretions and adhesions in inveterate cases. I succeeded in this way in reducing a luxation of thirteen weeks duration.

4. While the extension is made in any way, some have employed a rolling-pin, placed in the axilla, to raise the head of the bone to the socket, by seizing both ends of it, and making an upward exertion.

This plan seems to be futile, if not hurtful; for, as has been noticed already, as soon as the head of the bone is reduced by the drawing to the

the level of the socket, it jumps spontaneously into it; and if the rolling-pin be used here, the bone is so situated, that it will give unnecessary contusion, and perhaps prevent the reduction that would otherwise ensue by pressing its head against the projecting brim of its socket.

5. Instead of the rolling-pin, to raise the head of the bone during extension, some have advised, that the Surgeon should have a strong towel or scarf about his neck, with the doubling passed under the joint, near the armpit, and to make at the proper time a strong elevation, by raising himself, and inclining his neck backwards. This is equally unnecessary as the rolling-pin, but is not so likely to bruise the parts on which it presses,

6. By means of proper pulleys, fixed to the ceiling and to the lac, and connected by a strong cord, the patient has been hoisted, and even suspended for some time, to procure reduction of the luxated arm-bone, in obstinate cases. It has been imagined, that the resisting muscles thus be-

R.

come

come fatigued and relaxed, and their resistance diminished or destroyed. I tried this method unsuccessfully, in the case where reduction was effected by the foot-lever, as mentioned.

It may be remarked, that in this way the extending power is the weight of the patient's body; but in many instances, I am perfectly certain that a much greater power is wanted.

7. The lever supported on a proper fulcrum, assisted by a little windlass, or axis in peretrochio, has been recommended for accomplishing the business in question, under the name of Ambe; of which the most improved hitherto described is that of Mr Freck, of which an account is given in the Philosophical Transactions. I have seen this tried without effect; indeed the reason seems to me abundantly apparent: to render it probable, Mr Freck has made it so low, that the patient must sit on the floor, and the Surgeon stoop, while using it; and therefore due exertions cannot be made; and, upon the whole, it is unstable and too unsubstantial.

I have

I have corrected these defects in the ambe of Mr Freck, and given it additional powers, as will be understood from its figure in the tenth Plate.

The patient stands on the pedestal, and places the luxated arm gently bent, with the lac duly applied, on the lever, which is moveable in every direction. By means of a strong cord, the lac is connected to the little windlass of the lever; and any requisite extension is thus obtained before the lever is acted with, which enables the Surgeon to increase the extension at pleasure by depressing it; and the peculiar or universal joint, as it is called, permits him to roll the bone about its axis, which contributes greatly to make it quit its near situation, and to destroy concretions in old cases.

The fulcrum is about four feet high, which answers for patients of ordinary size. If it should be found too high, the patient may be duly raised by a stool, or the like, under his feet. If it be too low, it may be heightened, as will be af-

terwards explained. Thus it becomes universally applicable.

If, while the Surgeon uses the lever, the patient should raise himself, and so far elude its operation, he must be kept down by an assistant, with his hands applied on the affected shoulder.

If it should be found necessary to exert greater power, by the windlafs fixed to the side of the fulcrum, the lever, which is joined to the top of a square iron rod, with teeth corresponding to the pinion of the windlafs, concealed in the fulcrum, may be raised, and with it the patient, so as to suspend him, for the purpose already mentioned; and, finally, he may receive a jerk of any degree, to destroy concretions, or other obstacles, by allowing the iron rod to fall suddenly into its socket.

It appears that this modification of the ambe is capable to give any degree of extending power, and in any direction. I may venture to assert, that

that no curable case of luxation in the arm-joint can resist its influence. The Surgeons of our Infirmary found its successful power in one or two obstinate cases, that had not yielded to other methods.

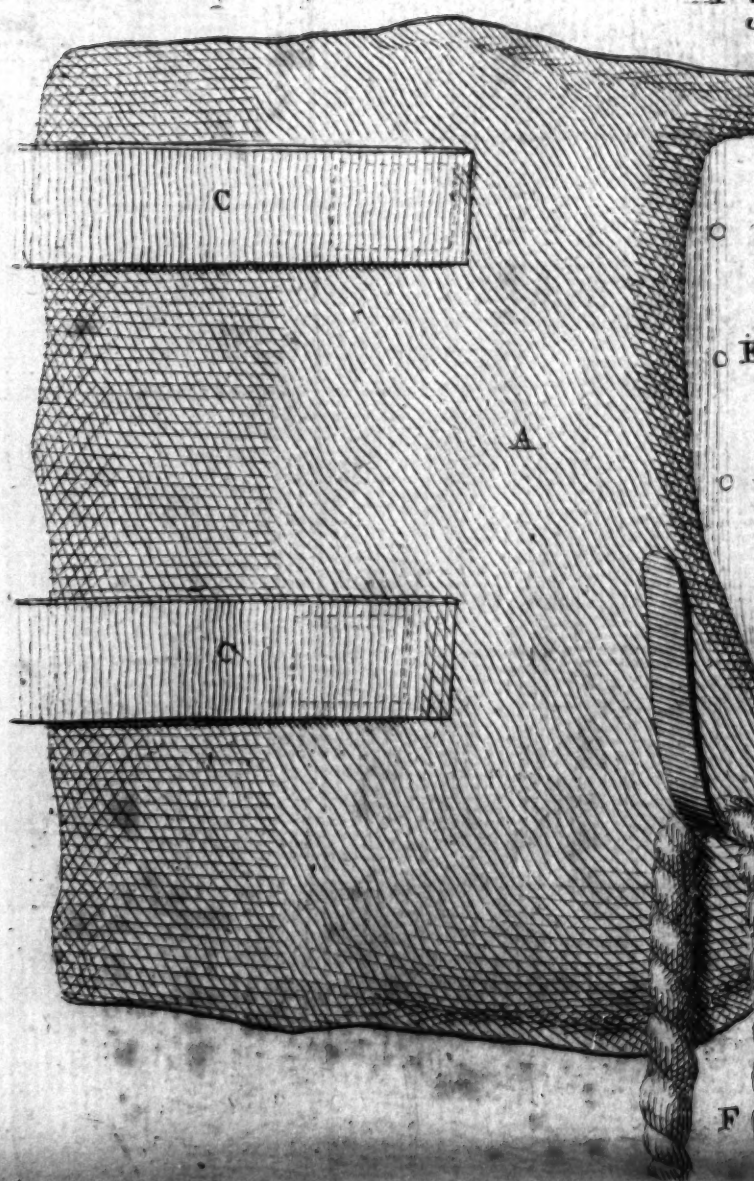
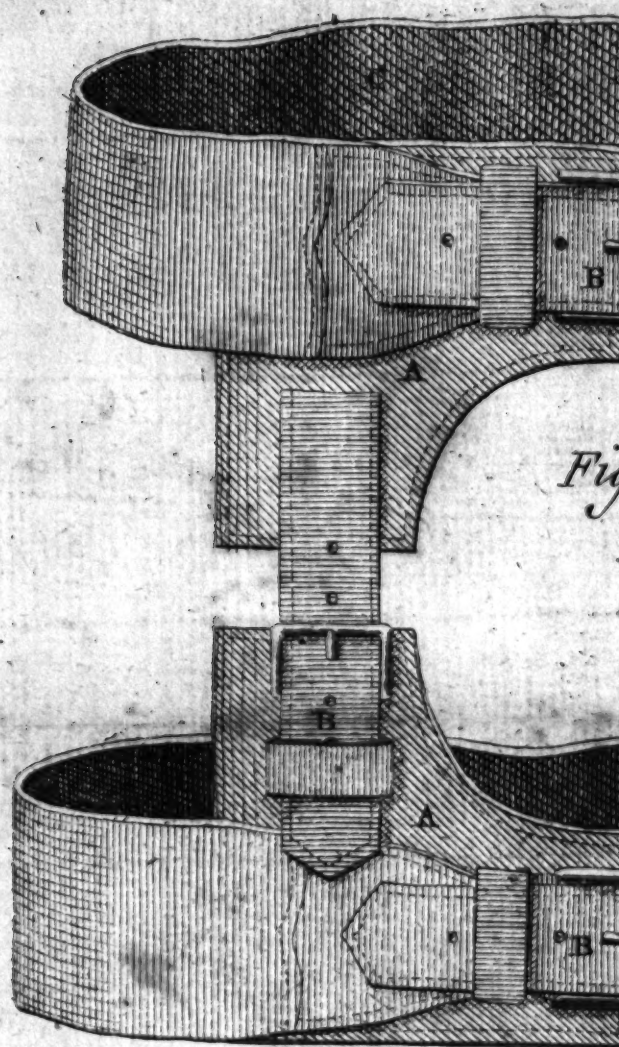
With regard to extension, I have repeatedly said, that it should be adjusted to the resistance, and gradually and cautiously encreased as this may require. When this is duly attended to, I think that no material injury can be done to the patient by tearing the muscles, vessels, &c. as some have imagined; for any supposable obstacle must give way before any thing of that kind that can happen.

I therefore conclude, that every case of luxation not exceeding perhaps three or four months duration is curable. Indeed I had almost ventured to say, that every case whatever is safely reducible by one or other of the plans described.

If in any case of this luxation retention is indicated, the spica scapularis bandage, applied so

as to invest the joint, which is easily done, and keeping the arm gently bent, and suspended in a scarf, will produce it. I have only found this necessary in one case; in which the ligaments and muscles seemed to have been more than usually lacerated.

EXPLANATION



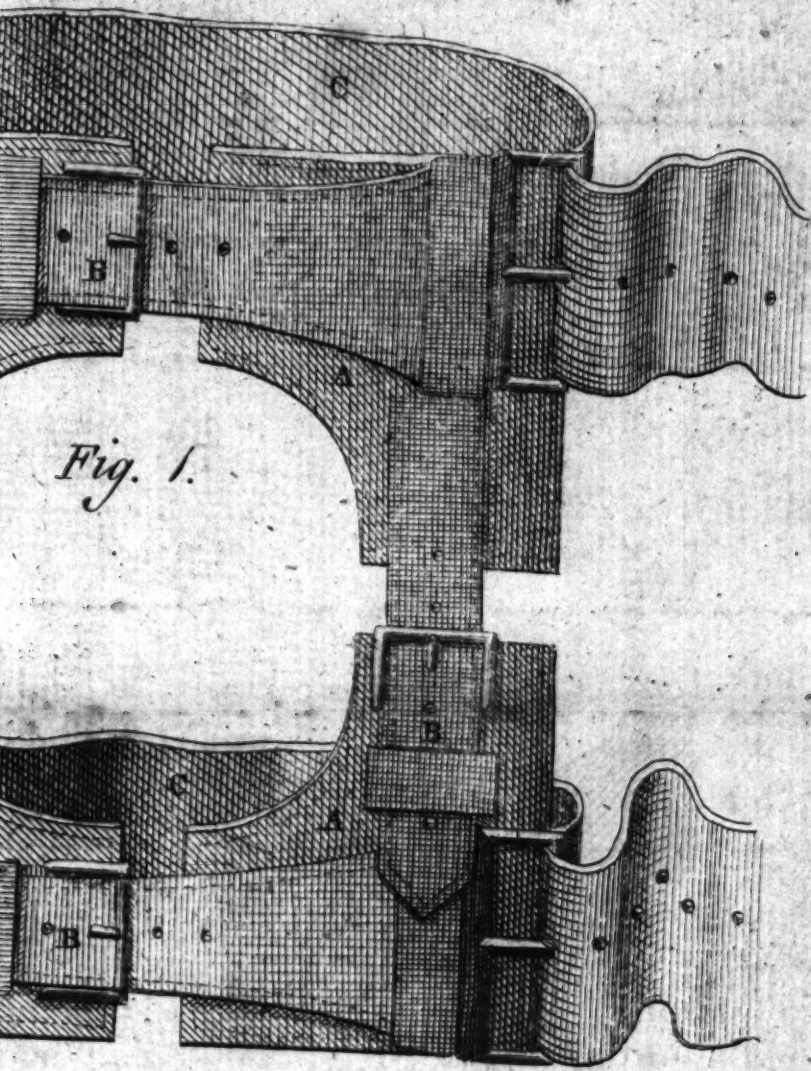


Fig. 1.

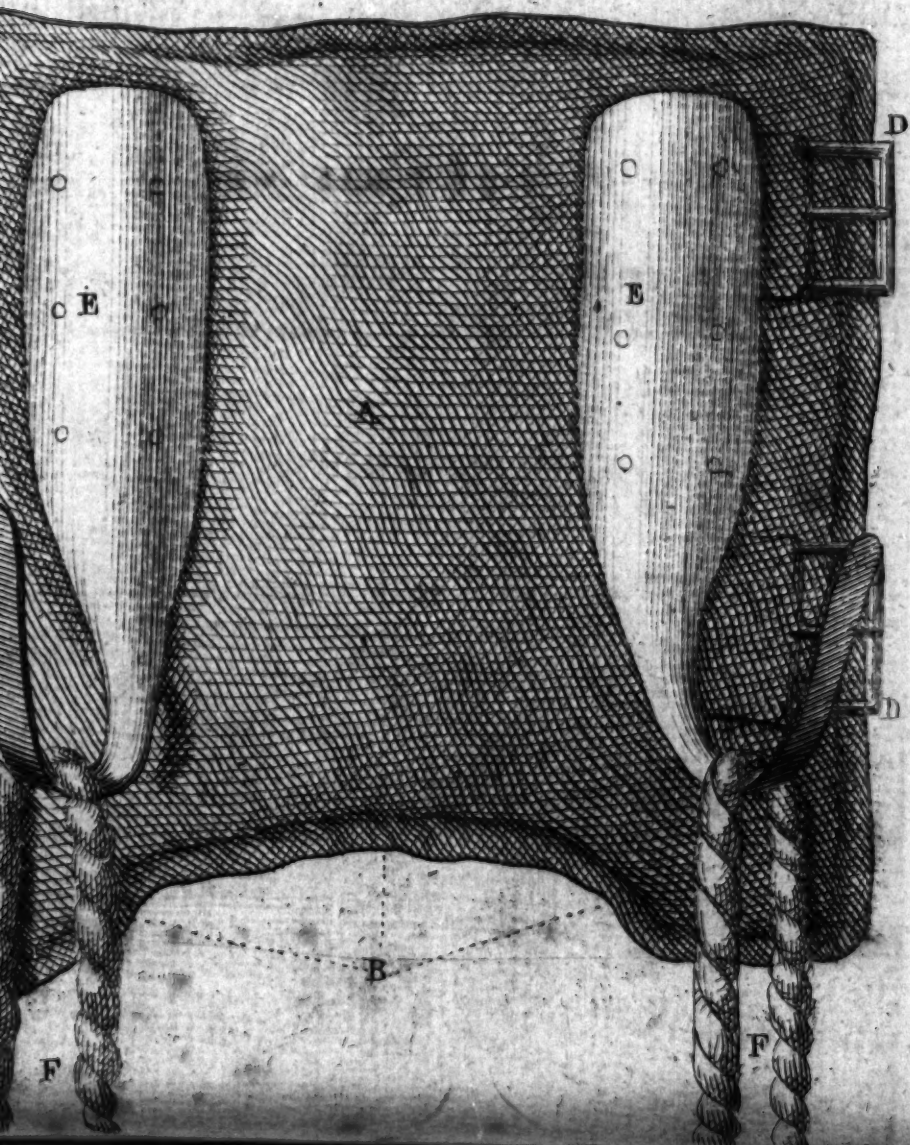
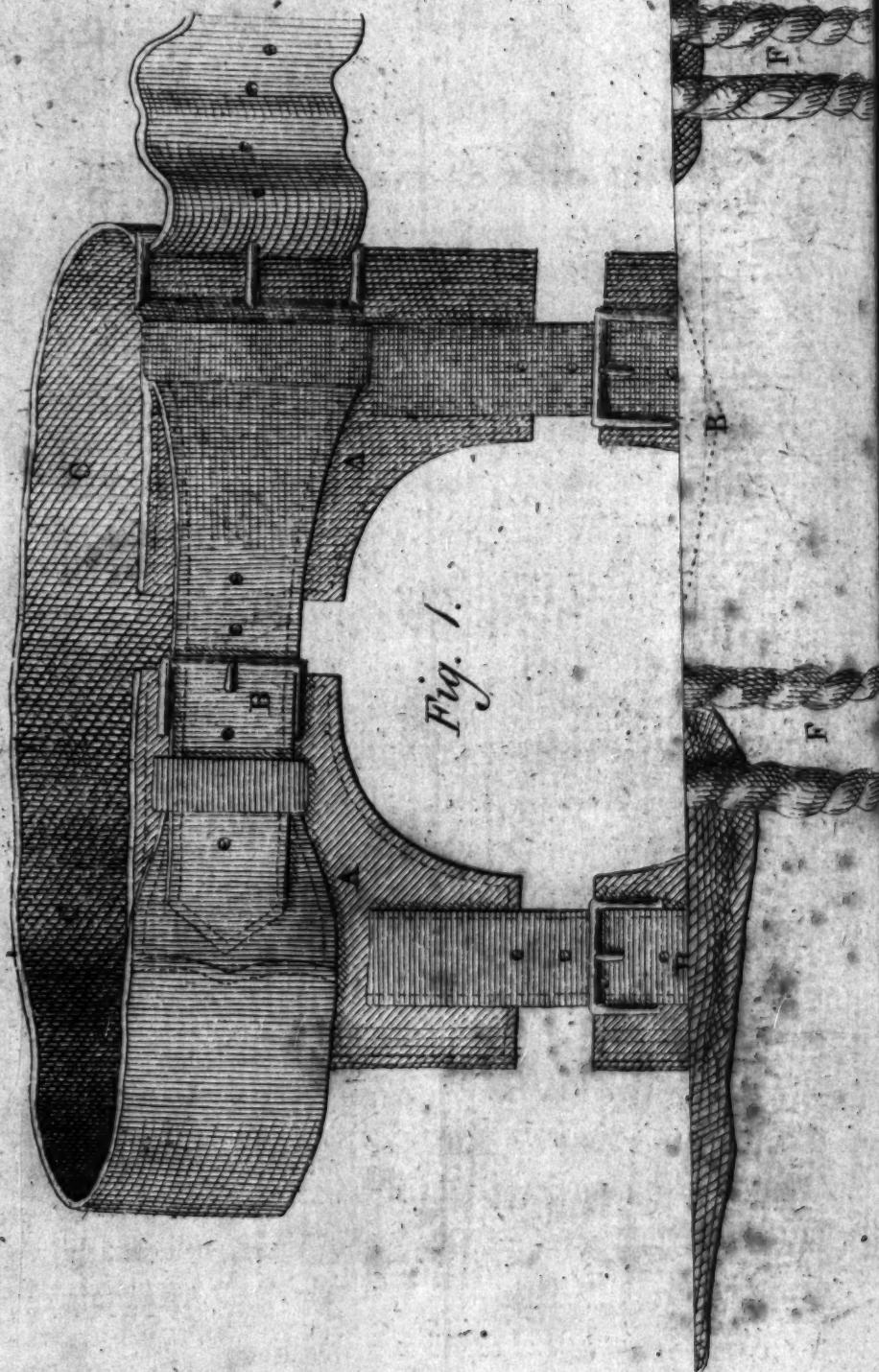


Fig. 2.



EXPLANATION OF THE EIGHTH PLATE.

FIG. 1. represents a bandage for the fractured patella, constructed of leather, calculated to surround this bone, whatever be its size, with any degree of tightness; and at same time to maintain its situation on the leg, whatever be the state of the knee as to extension.

AAAA, four stuffed pieces, that may be considered as compresses, connected by the short straps and buckles, in such manner that the distances between them relatively may be varied at pleasure, and consequently the size of the inclosure intended to lodge the patella, exactly adapted to it.

CCCC, two strong leather circulars, with buckles, (they may be stuffed, to prevent them from being irksome), that by surrounding the leg, the one above, the other below the knee, effectually maintain

maintain the situation of the other part of the bandage.

I don't know who is the inventor of this neat bandage; but I have already hinted, that it is not to be trusted without the assistance of the knee-part of the splints formerly described.

I lately examined a patella of a gentleman that had been fractured about eighteen months ago, and treated by the common bandaging; the distance between the fragments is at least five inches: he cannot as yet walk without halting. The long piece of supplemental soft matter, of the nature of ligament, interposed between the pieces, might have been superseded, or much shortened, by the plan of retention recommended above.

FIG. 2. exhibits a view of the lac to be applied above the elbow or knee, in order to favour extension, when the arm-bone or thigh-bone is luxated.

AA represents a piece of leather, of moderate thickness, so as to be flexible and pliant. It is here

here supposed to be somewhat stuffed; but I am uncertain about the propriety of this circumstance; for perhaps it contributes a little to make it lose its hold more readily than it would if unstuffed.

B, a notch in the inferior edge of of this piece of the lac, to lodge part of the surface of the forearm when bent.

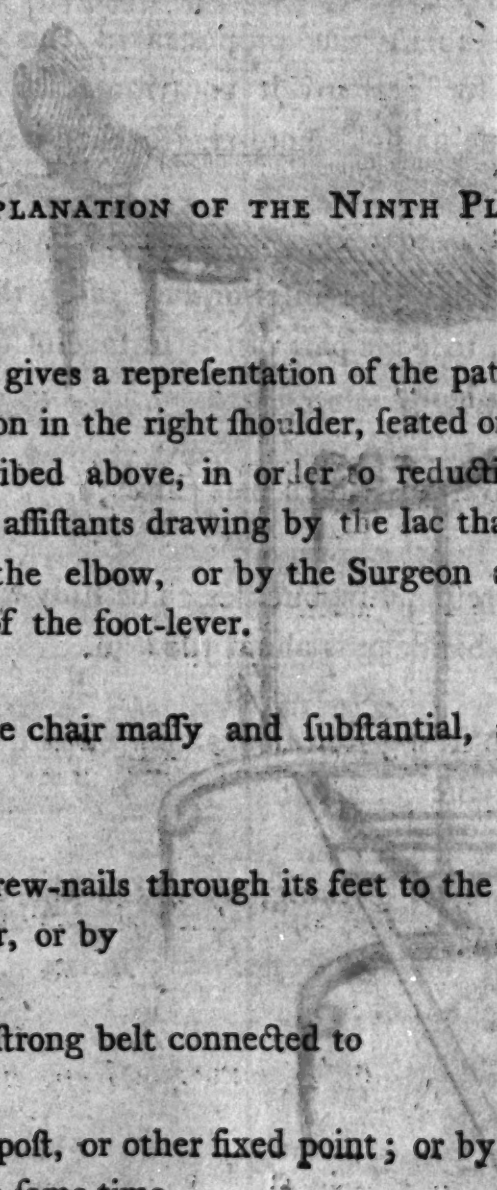
cc, two straps which pass through

dd, corresponding buckles, to be duly tightened when the bandage is about the arm.

ee, two strong iron hooks, placed as described, to receive the

ff, ropes, or girthing, by which the assistants are to draw.

EXPLANATION OF THE NINTH PLATD.



THIS gives a representation of the patient with a luxation in the right shoulder, seated on a chair, as described above, in order to reduction, whether by assistants drawing by the lac that is fixed above the elbow, or by the Surgeon alone, by means of the foot-lever.

A, the chair massy and substantial, and fixed by

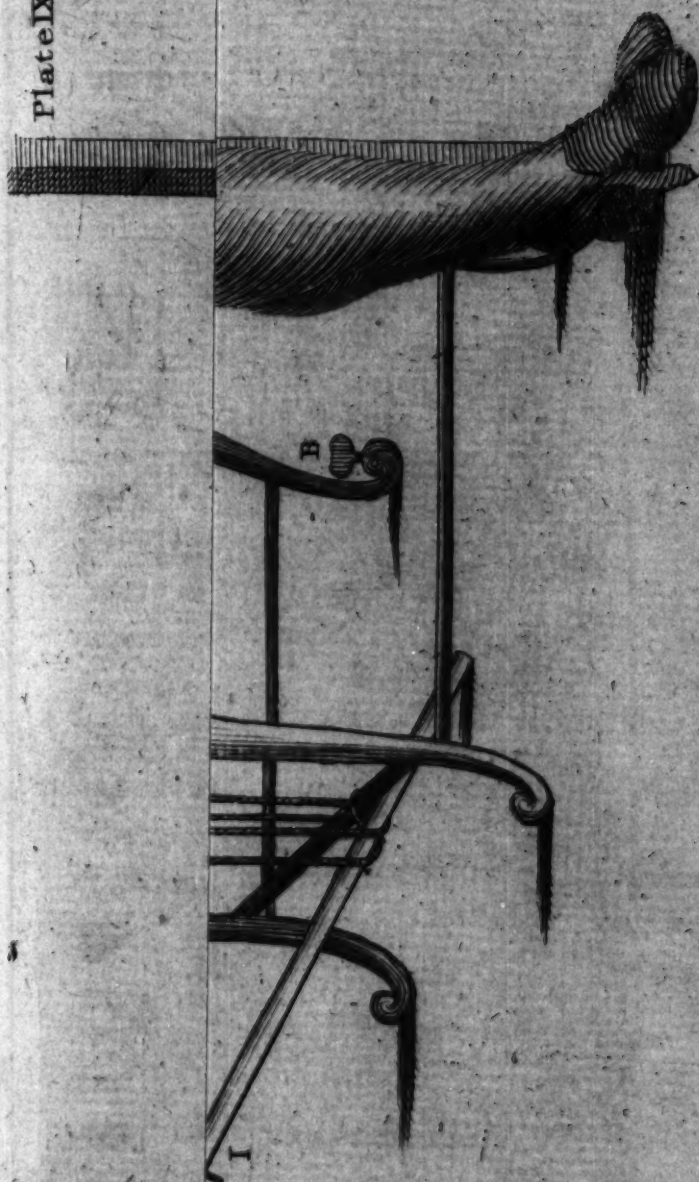
B, screw-nails through its feet to the boards of the floor, or by

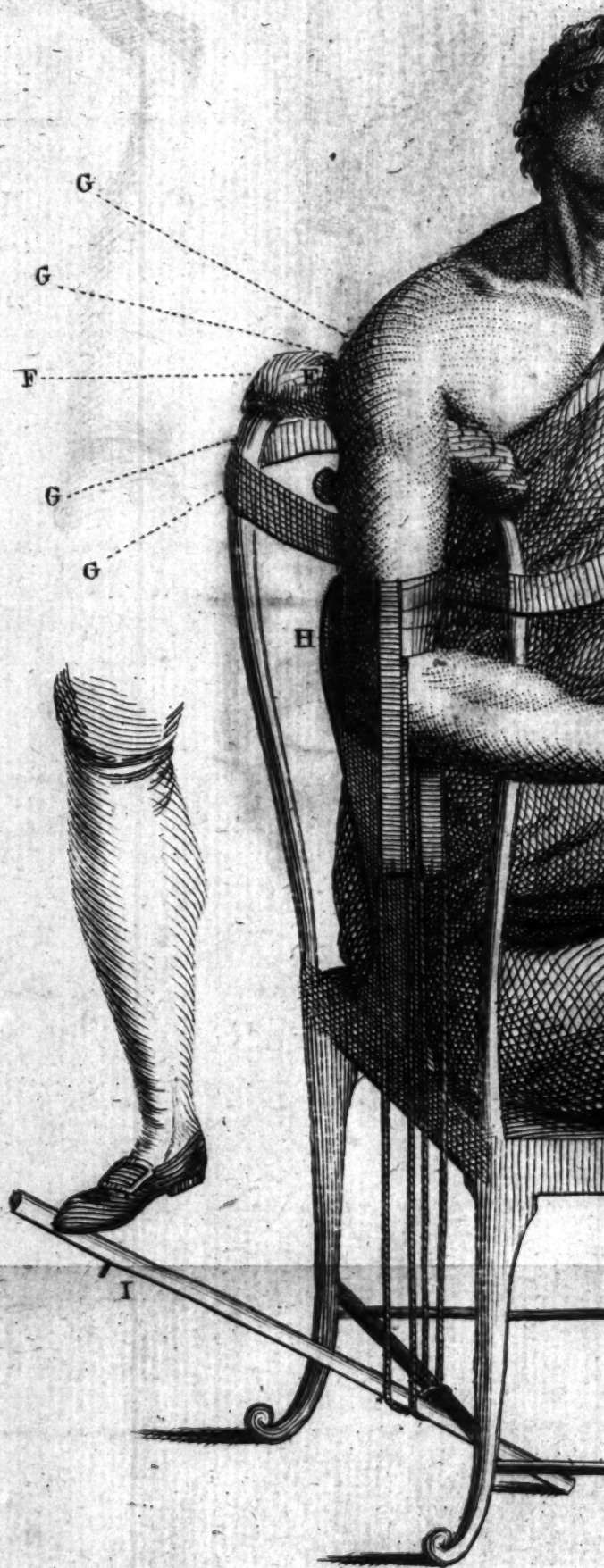
C, a strong belt connected to

D, a post, or other fixed point; or by both methods at same time.

E, the

Plate IX.







E, the top of the back of the chair, properly stuffed, or covered with a pillow or blanket, reaching to and lodged in the axilla, to prevent bruising during the extension.

F, the horizontal line passing through the axis of the affected joint, in which the drawing may be first attempted; and

G G G G, the various degrees of deviation that may be tried, according to the resistance. Success may be chiefly expected while we draw in the downward directions, for the reasons that have been assigned; which is rather a fortunate circumstance, because it is not easy, unless the patient be seated very low, to draw in the superior directions. This, however, is very effectually and conveniently done by the Ambe described in the following Plate.

H, the lac formed by the roller and straps formerly taken notice of, which keeps its situation very securely during the severest drawing; and therefore in this respect, independent of its sim-

plicity, it is preferable to that described in the foregoing Plate.

1, the foot-lever, connected by means of strong cords with the lac : the end of it goes under the cross bar, between the hind-feet of the chair, by which it is counteracted, while the other is depressed by the Surgeon's foot. By this means a very effectual extension may be produced in the downward direction, especially if the jerking method is adopted. I have mentioned, that I thus succeeded, after almost every other method had been fruitlessly tried, in a case of thirteen weeks standing.

It has been remarked, that making the arm or dislocated bone roll about its axis excellently favours the reduction, by disengaging its head from its new situation, and breaking any adhesions that may have been formed, and increasing the resistance. This is done by laying hold of the fore-arm near the elbow, and cautiously using it as a lever, to turn or roll the arm as may be necessary.

EXPLA-

Fig. 3.

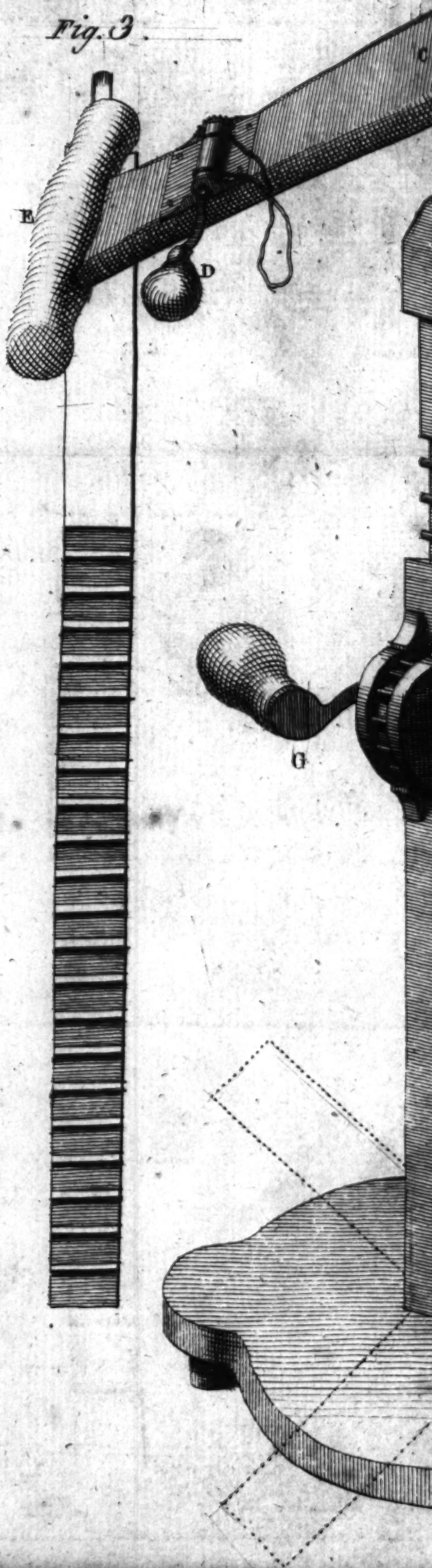


Fig. 1.

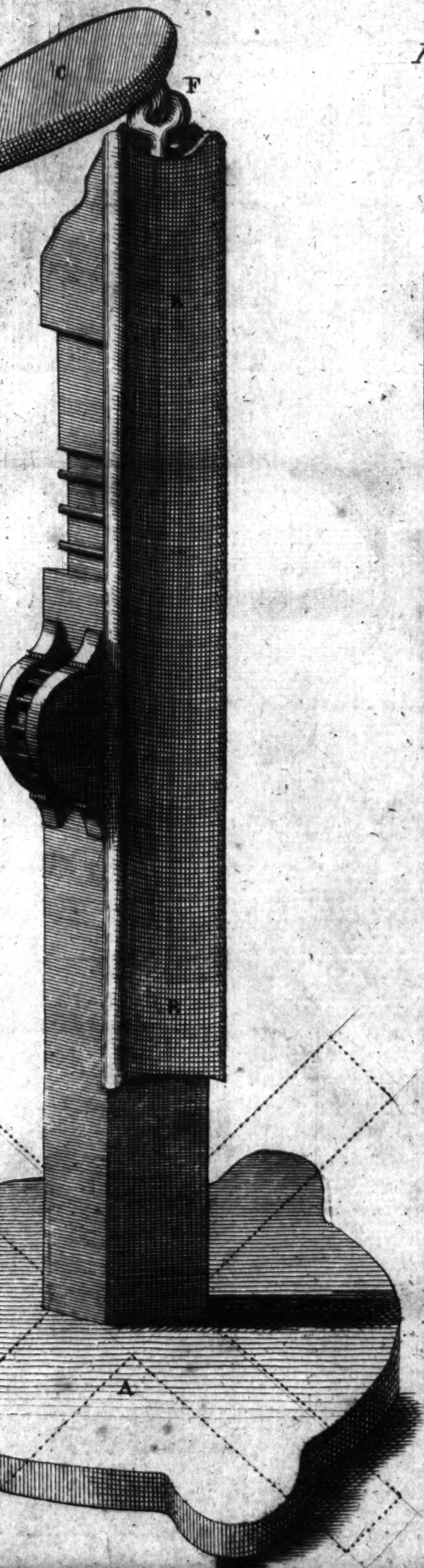


Fig. 2.



Plate IX.

Fig. 1.

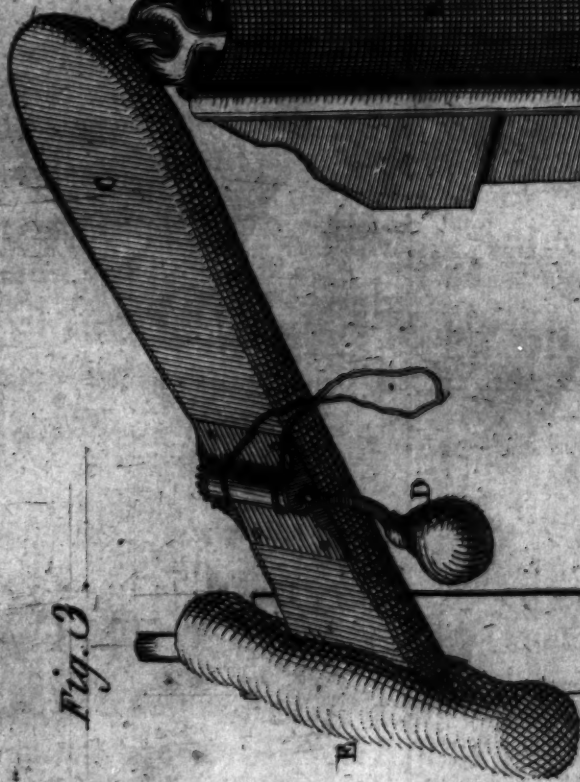


Fig. 3.

Fig. 2.



EXPLANATION OF THE TENTH PLATE.

THIS Plate represents the improved jerking Ambe for reducing the luxated arm-bone.

FIG. 1. gives a view of the entire Ambe.

A, the pedestal, of a roundish form, supported on three short feet. It may be made in the style of a cross, as represented by the dotted lines; which is perhaps the best form, as the two pieces making the cross may be taken asunder when the fulcrum is removed, and thereby rendered more portable.

BB, the side of the fulcrum, to which the patient's side is applied, a little hollowed. This circumstance is not strictly necessary.

cc, the lever, of a broadish form, and the upper

per surface a little hollowed, the more commodiously to lodge the dislocated arm when its point reaches to the arm-pit. It may, especially at its end, be somewhat stuffed, to prevent irksomeness and contusion.

D, the little windlafs on the lever, at such a distance from its rounded end as to allow the arm of the tallest man to lie on it bent, so that the cord connected with it may reach the lac above the elbow.

E, the cross head of the lever, to be occasionally seized by both hands of the Surgeon, so as to enable him to roll the patient's arm about its axis, for the purpose formerly mentioned.

F, the universal joint, which consists of two loops: the upper one passes through the lever, and is riveted into a small iron plate, concealed by the stuffing, so as to allow the lever to move freely in a horizontal circle. The under one is formed in the top of the iron bar that is lodged in the fulcrum. Thus a combination of the motions permitted between the two loops, and between the upper one and the extremity of the lever,

lever, produces the motion in all directions; and consequently a great deal of the efficiency peculiar to this ambe.

c, the greater windlafs fixed on the fulcrum, so that its teeth, which should be of iron, and justly made, catch on those of the iron rod, represented in the third figure of this Plate. By turning the handle, therefore, in one direction, the iron bar is necessarily and proportionally projected from its sheath in the fulcrum; and consequently the patient fixed to the lever by the luxated arm, as described, is elevated from the pedestal of the ambe, and suspended; and, by turning the opposite way, the rod is retracted into its sheath, and the patient allowed to descend. If this motion is performed suddenly, it gives the jerk, that so effectually contributes to destroy resisting adhesions in inveterate cases.

FIG. 2. exhibits a view of the iron bar retired from its sheath. It ought to be sufficiently strong to suspend the heaviest man without danger of bending, and of such length as to allow a projection

projection of eighteen inches or two feet, for the purpose of suspending and jerking.

H represents a small friction-wheel lodged in the inferior end of the rod; and on its side opposite to the windlafs, to facilitate its motion. Another, nearly similar, is placed at the upper part of the sheath, corresponding to the same side, for the same purpose.

It will be understood, that the power of raising the patient is as the diameter of the wheel of the windlafs, and the length of its handle, i. e. the less the former, and the longer the latter, the greater the power; so that the weakest operator may thus, with one hand, easily raise the heaviest patient; especially with the assistance of the two friction-wheels placed as tioned.

FIG. 3. represents the teathed side of the lever, that it may be understood how it is affected by the

the teeth of the pinion when in its sheath, as described.

It has been mentioned, that the two pieces forming the cross pedestal of this Ambe may be taken afunder, and thereby rendered more portable than the round pedestal. It may be now added, that the lever connected with the iron bar, and the fulcrum retired from its socket in the pedestal, may be packed with the cross pieces, so as to be abundantly portable on a man's back on a horse, or behind a carriage: A circumstance extremely convenient when the patient cannot be brought to it.

This socket perforates both pieces of the pedestal, and the tenon is secured by a horizontal plug, formed somewhat like a wedge, that secures the fulcrum against any motion with respect to the pedestal.

In my opinion, Mr Freck has in a great measure destroyed the utility of his modification of

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the

the Ambe by his anxiety to make it very easily portable. A machine of this nature must be substantial; and any one less so than that now described will be found to be so far disqualified to produce its due effect.

OF LUXATION IN THE HIP-JOINT.

IN order that our bodies might enjoy the necessary stability in the various attitudes, it was absolutely requisite that the inferior extremities or legs should be securely articulated to the trunk, while they possessed a very ample share of motion. Accordingly we find, that the acetabula, or deep sockets, that receive the heads or balls of the thigh-bones, are wrought in lateral and somewhat anterior points of the ossa innominata, or haunch-bones, which finish the skeleton of the trunk below.

The ball of the thigh-bone is fixed in the acetabulum, not only by the common capsular ligament, peculiarly strong, but by an internal liga-

ment of great strength. These unquestionably must be lacerated when a dislocation of the head of the thigh-bone takes place, which is called luxation in the hip-joint.

Nature has guarded against luxation in this joint, not only by its strong ligamentous apparatus, but by the depth of the socket, especially at its upper and posterior parts; where the weight of the trunk and burdens is thrown in the standing and stooping attitudes, and also by the attachment of strong and short muscles near it; which must be greatly stretched, deranged, and perhaps partly lacerated, when luxation takes place.

It will now be understood, that great external violence in general will be necessary to be the occasional cause of idiopathic luxation of the thigh-bone. Indeed sometimes a smaller weight or stroke than might be supposed adequate has this effect, when they chance to act so that the thigh-bone assists them as a long lever.

Besides the common symptoms, the luxation in
question

question is discovered by the shortening of the corresponding leg, and the altered position of the foot or toes.

The leg is necessarily shortened in all luxations of the thigh-bone, in which the head of it slips above the level of its socket. Indeed this change is not peculiar to this luxation; it takes place in that of the arm-bone, although not so remarkably.

The altered position of the foot and toes is a good deal characteristic of luxation of the thigh-bone: in general, with respect to a vertical plane, which we may suppose to divide the body into lateral halves, the toes, or point of the foot, are turned more or less inwards; especially when the dislocated ball has mounted on the dorsum of the os innominatum, owing to its projection from the axis of the body of the bone, and the action of the muscles attached near it.

The dislocated ball is sometimes lodged on the brim of the pelvis, under Paupart's ligament, and can be easily felt in the groin. I think I
once

once discovered it in an inveterate case under the arch of the pubes. In some instances, the ball may incline so much backwards as to be somewhat in or near the ischiatic notch.

All these specialities are to be distinguished by very careful examination, and anatomical information.

It was formerly mentioned, that luxation might be mistaken for fracture near a joint; and, vice versa. Accordingly fracture of the neck of the thigh-bone, to which its almost transverse position renders it peculiarly liable, and luxation in the hip-joint, have been often confounded. The peculiar grating of the fragments, which marks fracture, is sufficient to give a discrimination.

The requisite extension to reduce the luxated thigh-bone must be great, and consequently comparatively difficult, on account of the strength of the numerous muscles, that, by their usual as well as morbid action, gives resistance.

Without

Without attempting to recount the various projects and machines that have been devised for extension of the luxated thigh-bone, I shall content myself with explaining the methods of doing it that I have found to be the most simple and efficient.

The patient is laid with the affected side uppermost, on a table covered with a matras or blankets, or both, and his body is rendered immoveable, with respect to the extending power, by connecting it securely with a fixed point on the opposite side of the room. This is much preferable to what has been called counter-extension by assistants, to prevent the patients yielding or shifting place during the extension.

Having often seen the extending efforts baffled by this circumstance in our Infirmary, I ordered a strong ring to be fixed in the railing, a little higher than the table on which the patient is laid, I then connected him securely to it, in the following manner, which may be done in any room,

A rolling-pin, of sufficient length, with its middle part well covered with doublings of flannel, is placed in the pærineum, or applied to the bottom of the pelvis: the ends of a strong piece of girthing, the middle of which is fixed in the ring already mentioned, are respectively tied to the extremities of the rolling-pin. Between the flannel around the rolling-pin and the pærineum, a bunch of tow or wool may be interposed, to give as much security as possible against contusion.

It will be understood, that by this plan the patient is rendered immoveable with respect to the extending power, which necessarily gives it full effect. Accordingly I believe the other Surgeons of our Hospital have ever since adopted it.

A sufficient number of strong assistants constitutes, I think, the most trusty extending power. They draw by ropes or girthing, of sufficient length, fixed to the affected thigh, while the knee is bent, by means of the lac already described; which seems to be indispensable in this business,

on account of its maintaining its situation, altho' the extension be very great. It is accordingly now the only lac used in our Hospital.

While the extension is performing, the Surgeon ought to stand behind the patient, to regulate, with great judgement and caution, every circumstance, particularly the degree and direction of the drawing.

It has been remarked, that as well in fracture as luxation, we should begin with low or gentle degrees of extension, and encrease it gradually, and only as the resistance may indicate. The requisite degree in any assignable case can only be determined by strict attention to circumstances; which therefore demand due vigilance from the Surgeon. In general, however, I may venture from experience to say, that he ought not to be too timid and unpersevering, otherwise he may abandon the trial in the moment when a little more power and patience would have crowned his wishes.

I have never seen any bad effects from what some would perhaps deem over-extension. I can scarcely conceive, that there can be any almost in any case; the resisting substance, whatever it be, must yield, and be destroyed, before the muscles, or vessels in general, can be much stretched or injured.

As was observed concerning the arm, while extension is proceeding, the knee being bent, the leg is laid hold of by the Surgeon, with both his hands, near the knee, and employed as a lever, to roll the thigh-bone about its axis, for the purpose repeatedly taken notice of.

The patient always complains loudly of the pressure or re-action of the rolling-pin on the perinæum, however well it be covered, which the Surgeon must endeavour to alleviate as much as possible.

It will immediately occur, that instead of the covered rolling-pin, a cushion, properly sized, and fixed to the girthing, may be employed.

The

The former, however, will in general be preferable, on this account, that in obstinate cases, while the extension is strong, the Surgeon can lay hold of the ends of it, and make an effort to raise the head of the bone to the level of the socket, to facilitate the reduction; which I once observed to succeed. Indeed this can be done, altho' the cushion be adopted.

After trying the horizontal direction, if necessary, the superior and inferior ones, as was observed with respect to the luxated arm-bone, may be tried; and the assistants should be previously instructed to act in concert, and to vary the line in which they draw regularly when ordered.

The moment the luxated bone is retracted to the level of its socket, it cannot fail, provided the extension is remitted, to re-occupy it; and in recent cases it gives it an audible stroke; but in inveterate ones, on account of the socket's being somewhat changed by the absence of the usual pressure, this is less remarkable, and sometimes altogether imperceptible. In every case, however,

when the limb has regained its due length, and the foot its proper position, and retains them, although the extension cease, we may be certain we have succeeded.

The most trusty extending power, I have said, is that of assistants; but it may be remarked, that when necessary a sufficient one may be produced mechanically by the axis in peritrochio, or a windlass of proper size placed before the table on which the patient is laid, and fixed to the floor, or other immoveable surface. By connecting this with the cords from the lac, a well-regulated horizontal extension may be produced; and if the windlass is connected with a frame, forming a part of a verticle circle, of which the diseased joint is the centre, it may be suddenly shifted upwards and downwards on the circle, without slackening the extension; and consequently any requisite degree of varied direction obtained at pleasure.

It is not to be expected, that the private practitioner should have an apparatus of this kind. I think,

think, however, there should be such a one in every Hospital. Accordingly I have provided one adapted to the operation-room of our Infirmary.

I can scarcely suppose, that retention will be difficult in any case of this luxation, for the most obvious reasons. However, when necessary, it may be consulted and obtained by the spica inguinalis bandage, joined with proper posture, and abstinence from motion of the affected limb for some time:

OF LUXATION IN THE ELBOW.

THE articulation of the elbow resembles the common hinge, in so far as it possesses only flexion and extension, and those to such degree that the hand, in performing them, scarcely moves through a semicircle.

This limited motion of this joint, depending principally on the conformation of the extremities of the bones forming it, agreeably to the general principle stated above, renders luxation of the elbow comparatively unfrequent.

When luxation exists here, the extremities of the bones of the fore-arm are either retracted unduly behind, or projected, before the corresponding

OF LUXATIONS.

139

Corresponding one of the arm-bone, and therefore must be very easily discoverable.

Upon the supposition that the luxation is backwards, the patient's arm being gently bent, the Surgeon with one hand lays hold of the arm, and with the other the fore-arm, both near the elbow, and makes an effort to retract the bones of the latter, depressing them so that the coronoid process of the ulna may be somewhat freed from contact with the pulley, or trochlea, of the os humeri, or arm-bone. By this means the retraction is facilitated. When the patient is robust, it will be necessary to have an assistant to secure the arm, while the Surgeon exerts his whole force to retract the fore-arm.

If the luxation is forwards, (which is a rare case, and in the opinion of some the olecranon is for the most part fractured); an effort must be made, while the arm is firmly held as described, to depress the luxated extremities of the bones of the fore-arm, so that the olecranon may repass the pulley of the arm-bone, and regain its situation. The olecranon's being separated by fracture from
the

the rest of the ulna; will rather favour than retard the reduction.

I treated a case that may be called a compound luxation in the elbow. The bones were not only displaced, but there was a wound and fracture of the neck of the radius; by which its head was so detached, that I judged it proper to remove it. A cure followed, and a surprising share of the motion was preserved.

OF LUXATION IN THE KNEE.

THE surfaces included within the capsular ligament of the knee are greater than those of any other joint; and the motion is scarcely so extensive as that of the elbow: therefore, according to the general principle formerly stated, that the frequency of luxation, other circumstances being equal, is as the quantity of motion, it may be concluded, that it will seldom be the seat of dislocation. This is accordingly found to be so in fact.

The unfrequency of dislocation in the knee farther arises from the resistance of the cross ligaments within the joint, the presence of the femi-lunar cartilages, the broad tendon, that almost

X.

entirely

entirely invests it, and the muscles that either pass immediately over it, or have their tendons inserted near it.

From the premised circumstances, it will be evident, that great external violence alone can be the occasional cause of luxation in the knee; and that much strain and very extensive laceration of the ligaments, &c. must attend it.

It farther follows, that the luxation in question will be easily discovered, and as easily reduced.

OF LUXATION IN THE WRIST.

THE Wrist is a kind of the ball and socket joint, and consequently has motion in all directions. The ball is formed by the upper carpal bones; and the corresponding extremity of the radius supplies the socket.

Luxation in this joint is most commonly produced by the ball mounting more or less on the external surface of the ends of the fore-arm bones. In consequence, the arm is shortened, and two tumors appear on the external and internal surface, near the wrist; the one caused by the displaced ball, and the other by the ends of the bones of the fore-arm, which in one instance I saw protruded through

the soft parts, and somewhat flattened by the violence of a fall from a high house. This is a case of compound luxation before alluded to. The person recovered, but with great loss of motion in both wrists, for both were thus affected.

The reduction cannot be difficult, when the fore-arm is firmly held; while the requisite extension is effected by drawing by the hand, and moving the dislocated ball, to facilitate the operation.

OF

OF LUXATION IN THE ANKLE.

THE Ankle is a hinge-formed joint, possessing, along with flexion and extension, a considerable lateral motion. The upper part of the astragalus is received, into a corresponding excavation, in the end of the tibia, guarded on one side by a strong process of the tibia, commonly called the inner ankle; and on the other side, by the extremity of the fibula, which is the outer ankle.

A backward or forward luxation takes place in this joint, according as the astragalus (and consequently the foot) is pushed unduly behind or before the corresponding end of the tibia. In the former, the heel seems to be lengthened,
and

and the foot shortened; and in the latter, the contrary.

The reduction is easily effected, by drawing by the foot, while the leg is firmly secured against motion, and, when from the resistance it seems to be necessary, the knee ought to be somewhat bent.

A P.

A P P E N D I X.

OF THE CLUB-FOOT.

THE Club-foot partakes very much of the nature of a Luxation in the ankle: in fact, it may be considered as a lateral dislocation in this joint, produced, in my opinion, by a mal-position, or undue crossing of the legs in utero, by which the evolution of the inner ankles (processes of the tibiae as mentioned) is hampered, and the astraguli are not duly confined in their excavations, so that the soles are turned towards one another; and in the standing attitude the body rests on the outer edges of the foot, and sometimes

sometimes on the outer ankles. In some instances this affection is extended to the knee; and in others, comparatively few, it is accompanied with a withering or shrinking of the leg and thigh.

This disease or deformity, when confined to the ankle, or perhaps extended somewhat to the knee, admits of a cure on the same principle as luxation, provided we begin our attempts early; that is, as soon after birth as possible, and persevere duly.

The reduction, or replacing of the foot, is an easy business. The whole task of the Surgeon, therefore, almost consists in retention, that the evolution of the faulty parts may be favoured, and at last completed.

The retentive means, that they may be effectual, must be the most simple, giving to the infant as little pain, and to the nurse as little inconvenience, as possible. The machine represented in the first figure of the eleventh Plate is of this description. It is softly lined and quilted,

quilted, when the foot is placed in it; and it should be well adjusted. It is shut and secured by a strap or ribband. It must be very constantly worn; and being made of hardened leather, or of tin or copper plate, it is impenetrable to moisture, which is a great circumstance of convenience.

When the knee is affected, two splints, lined and quilted, and properly adjusted, must be worn for the requisite time. These lay hold of the knee, and keep it, the leg and foot in their due relative position.

OF THE SUPPLE-JOINT.

AN undue luxity of the ligaments, allowing involuntary motion, has most frequently occurred in the ankles.

In such a case, the machine represented in the third figure of the eleventh Plate has been found to produce essential service.

It will be observed, that it much resembles that formerly recommended for the fractured leg:

There

There is this difference, however, the splints are so connected with the heel of the shoe, that while flexion and retention are permitted, the lateral or hurtful motion is entirely prevented.

EXPLANATION

EXPLANATION OF THE ELEVENTH PLATE.

FIG. 1. is a representation of the machine for the club-foot, when the affection is confined to the ankles. It much resembles the boot of Hildanus.

FIG. 2 exhibits a view of the splint recommended, when, along with the club-foot, the knee is more or less affected. The splints, as they are to be long worn, must be well adapted, and the lining very soft, and quilted.

FIG. 3.

Fig. 3.

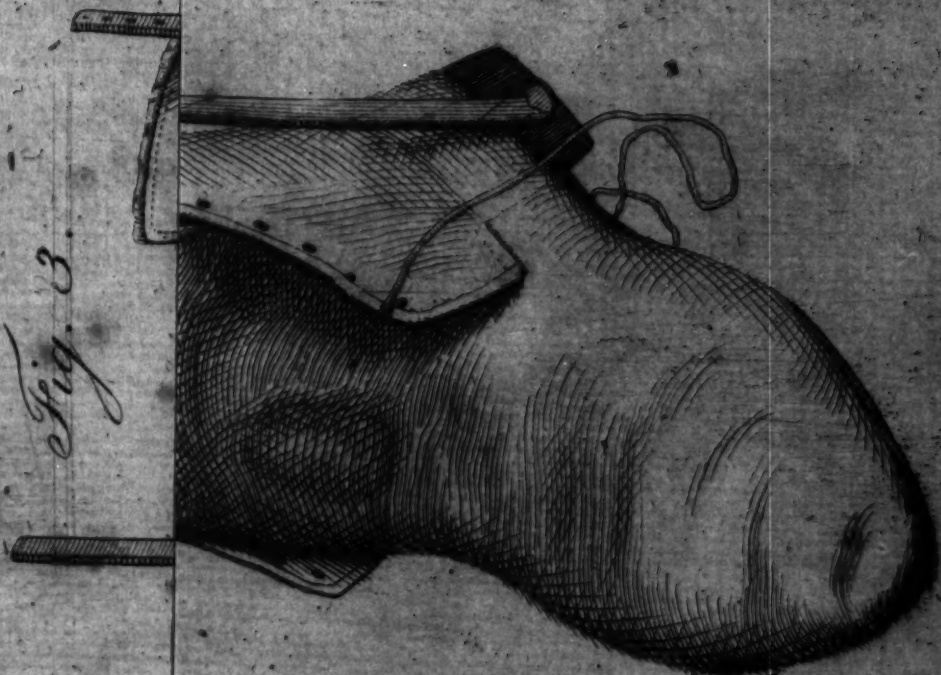


Fig. 1.

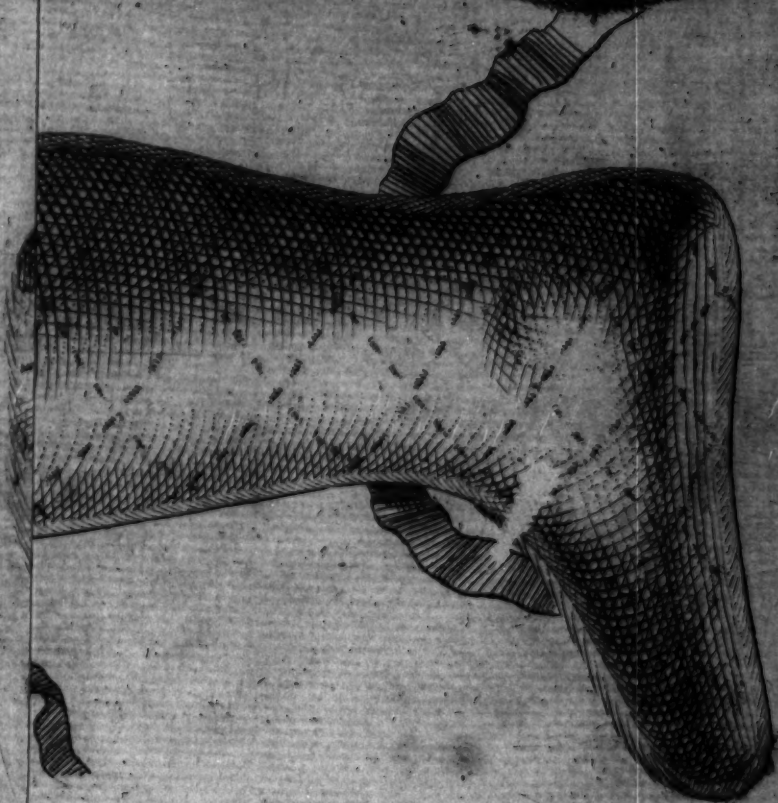


Fig. 1.

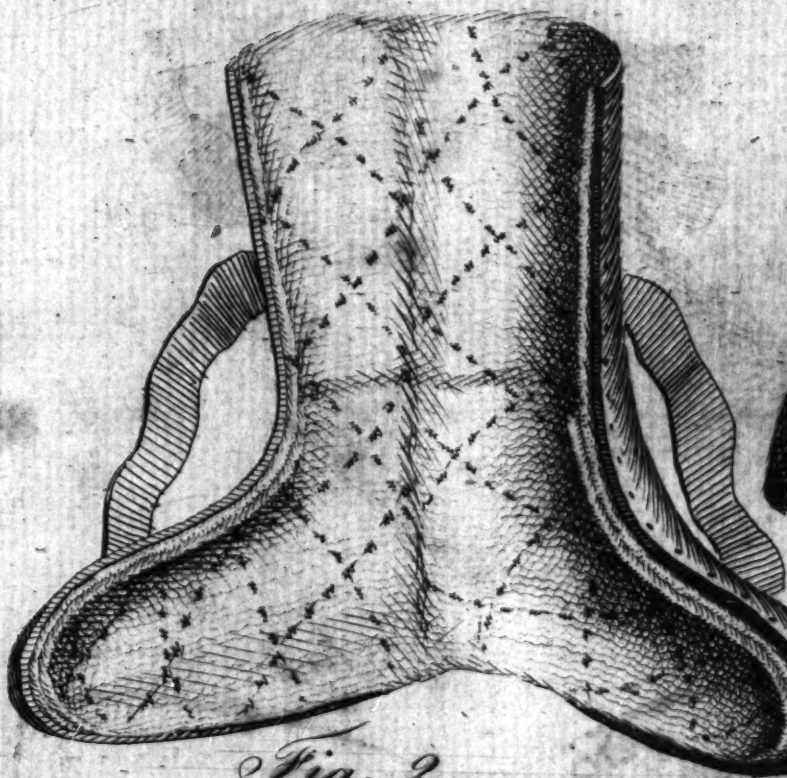


Fig. 2.

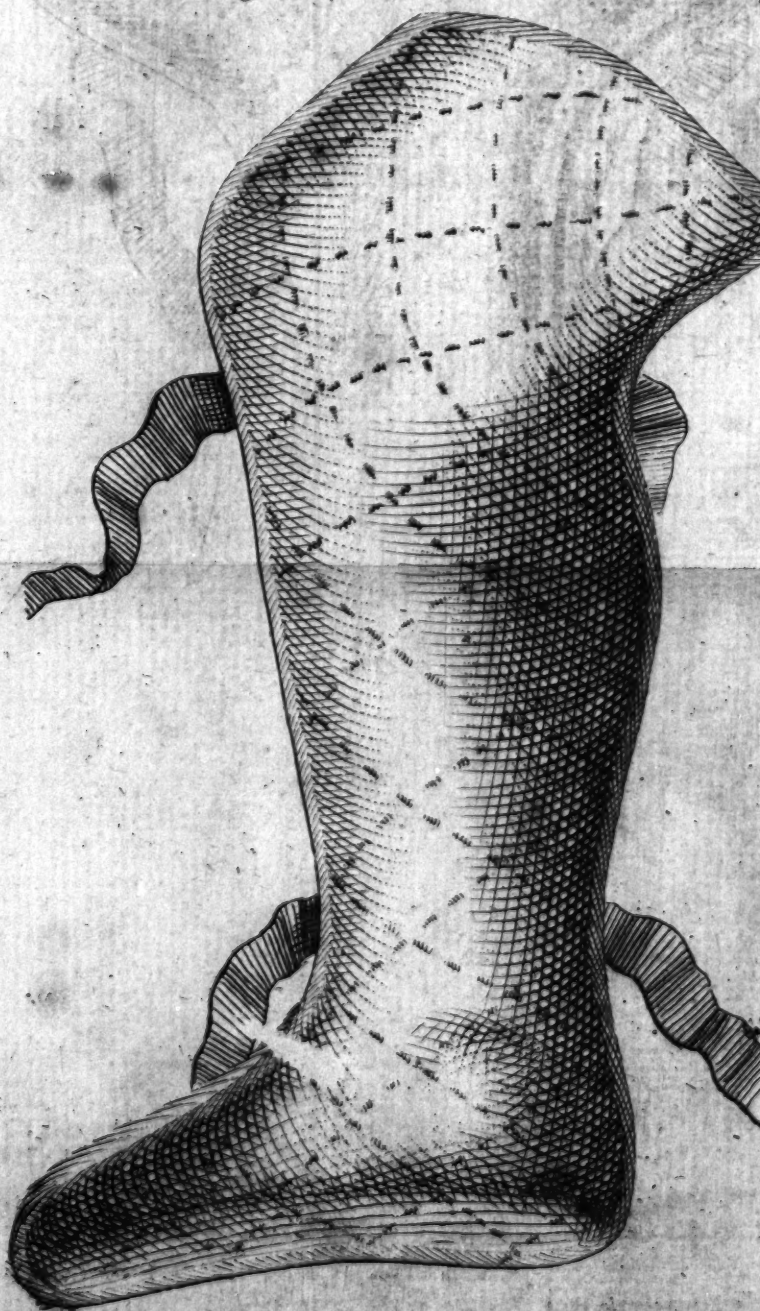


Fig. 3.

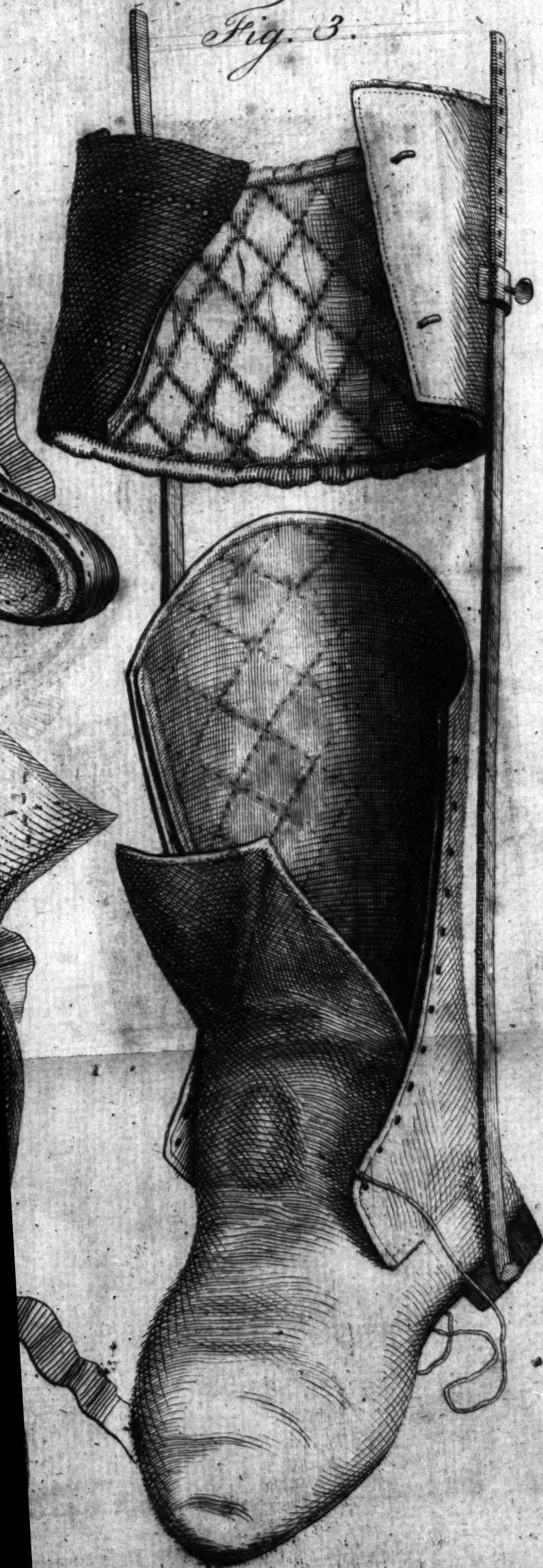


FIG. 3. gives a view of a machine for securing the ankle, in cases of too great flexibility, against lateral motion.

T H E E N D.

E R R A T A.

Page line

- 16. 10. FOR where READ when
- 38. 3. AFTER under INSERT them
- 76. 1. FOR this READ these
- 80. 14. LEAVE OUT OCCASION
- 87. 5 FOR two READ other
- 114. 1. AFTER primary INSERT disease
- 115. 12. FOR luxated READ lacerated
- 121. 4. FOR gloinid READ glenoid
- 126. 8. AFTER which INSERT there is a
- 130. 17. FOR probable READ portable
- 131. 15. FOR near READ new

DIRECTIONS FOR PLACING THE PLATES.

Plate	Page
1. to face	86.
2. -	88.
3. -	ib.
4. -	90.
5. -	ib.
6. -	98.
7. -	100.
8. -	138.
9. -	140.
10. -	146.
11. -	172.

2020-2021 Q218 U.S. Census Bureau

1947

THE UNIVERSITY OF CHICAGO

1940

100

90-6-74

1941

100

1990

2. 1

1990

1990

